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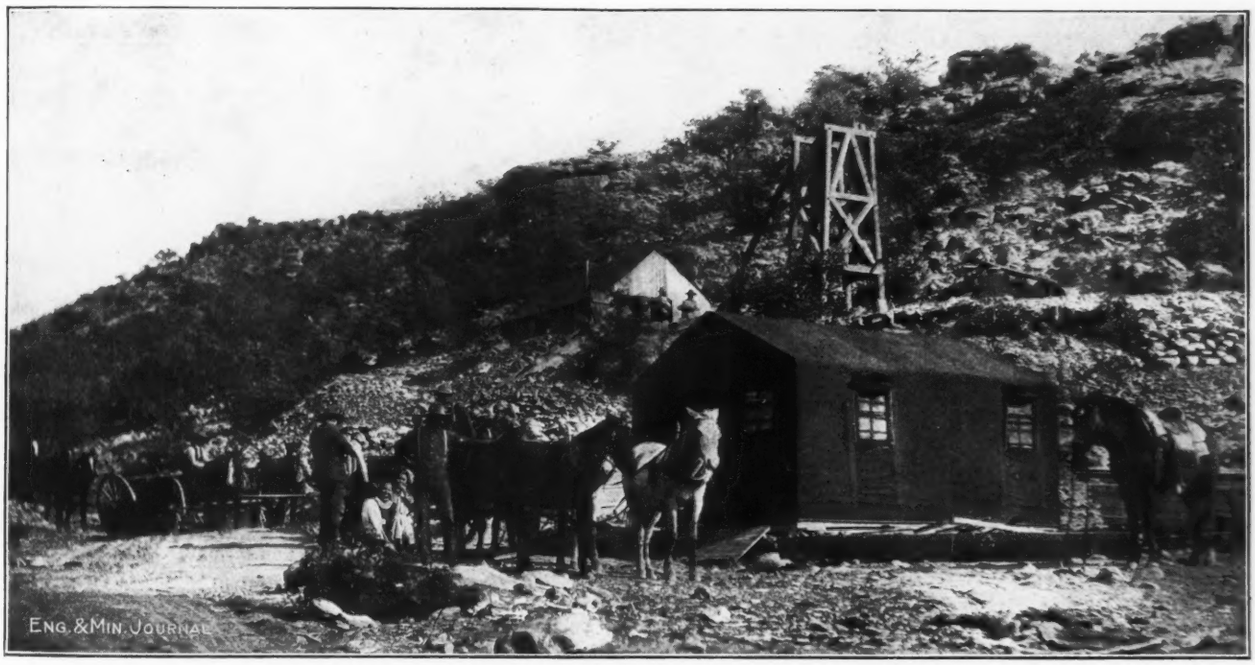
Lucky Bill Lead-Vanadium Mine

By Paul A. Larsh*

SYNOPSIS—Lead-carbonate and lead-vanadate ores, in a filled fault fissure, can be readily sorted into lead and vanadium classes, but better vanadium prices are obtained by melting out the lead and selling the vanadium-bearing slag.

The Lucky Bill mine is one mile from Bayard, Grant County, N. M., a station on the Santa Rita branch of the Santa Fé railroad. Freight to El Paso, Tex., the nearest custom reduction works, is $1 per ton for ores of less than $100 per ton value.

The mine was located 12 or 15 years ago, the discoverers working it themselves, and leasing from time to time, until they finally sold out to the Bogue & Wensley Mines Co., which operated the mine for some time and later leased it. In May, 1911, I crossed the property and was impressed by the presence of large amounts of lead vanadate in the dumps, which, up to that time, had been called "lead oxide" or "yellow carbonates." In June, 1911, having secured a lease and option, I began operations under the partnership of Ross, Larsh & Co., and in June, 1912, the deed for the property was taken up.



Surface Plant at Lucky Bill Lead-Vanadium Mine

Ore Occurs in a Fault Plane

The vein is a filling of a contact quartz fissure in one of the largest, if not the largest faulting planes in the district. The fault has a throw of 300 ft. The overlying rocks where not removed by erosion are rhyolite and tufa several hundred feet thick. The underlying rock that contains the vein is quartz monzonite porphyry forming both walls. A crosscut from the vein on the 100-ft. level passes through 50 ft. of quartz porphyry, 14 ft. of tufa, and is being driven through a soft red porphyry. In the vicinity of the vein as far as the quartz porphyry has been explored, it is traversed by numerous quartz seams or veinlets highly impregnated with lead vanadates as fine canary-yellow, needle-like crystals. The overburden, tufa, in the vicinity of the vein, is also mixed with both vanadates and carbonates of lead. The smaller seams or cracks in the porphyry are filled with an asbestos-like lead vanadate, the whole, especially near the vein, comprising a stockwork probably of commercial value.

*Mining engineer, Albuquerque, N. M.

The vein or fault trends 35 to 40° northeast (magnetic), and can be traced several miles in both directions from the Lucky Bill. To the north the San José and Ivanhoe mines are on this fault. The extreme north portion passes into the Chino Copper Co. property, at Santa Rita, five or six miles distant, and the southern portion into the Lone Mountain silver-lead district.

The vein covered by the Lucky Bill claim is at the center of the fault. The formations from the southeast pitch strongly into the fault, from the northwest gently into the fault and a fold to the southwest and northeast makes the Lucky Bill oreshoot the center of a geological basin. The vein filling ranges from 8 to 50 ft. wide and dips about 60° to the southeast. The ores of shipping grade are on the hanging-wall side and range from 2 to 12 ft. in width; the average stoping width being between 4 and 5 ft. On the foot-wall side between the quartz and porphyry there is several feet of soft altered porphyry, assaying from 1 to 4% lead and from $^1/_{10}$ to 1% vanadium.

The vein is very irregular, making short curves resembling the course of the Rio Grande River, but, as a whole, throughout any considerable distance it holds to its true course. The quartz filling is hard, box-car-red silica where not entirely displaced by lead ores on the hanging-wall side, and a hard, porous red quartz on the foot-wall side. The latter shows unmistakable evidences of leaching. The entire vein and both walls for some distance from the vein show much alteration and are saturated with red oxide of iron and oxide of manganese.

Ore Contains 28% Lead

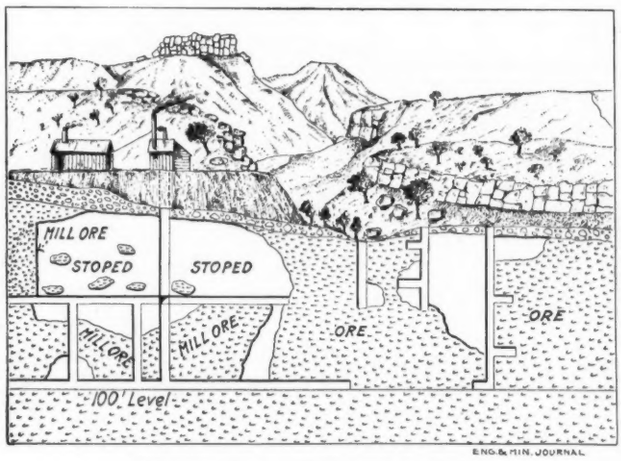
The oreshoot from which shipping ores come is 600 ft. long on the vein. It is explored and opened only to the 100-ft. level. There is a block of ground 175 ft. long from the Bogue shaft to the south end-line, which shows good ore in small drifts started from the Bogue shaft. A shaft is being sunk in this block which struck the vein at 14 ft. and is in good ore. Both north and south drifts on the 100-ft. level are (Mar. 24, 1913) in high-grade ore and the breasts are 450 ft. apart. Some 800 ft. of the vein is unexplored.

The average lead assay of all shipments made by Ross, Larsh & Co. is 27.72%. In this vein, as in most all orebodies, extremely rich shoots are opened. Here they consist of almost pure lead carbonates or lead vanadates. The largest shoot of this kind opened under Ross, Larsh & Co. operations was discovered on the 100-ft. level and produced $11,095 net in 37 days with two miners. This shoot was 12 ft. wide at the 100-ft. level and narrowed, going up, to 1 ft. at the upper level, where it connected with a shoot on the upper level that produced $6000 worth of ore in about 30 days with two miners. This upper shoot was 8 ft. wide and the drift was carried 8 ft. high. Afterward several cars of high-grade ore were stoped from above this drift. In many places on the 100-ft. level these high-grade ores are from 2 to 4 ft. wide in the bottom of the drift. When these ores narrow or are not present throughout the entire zone of enrichment, this zone will generally be filled with mine-run ore, assaying from 15 to 25% lead, which can be shipped at a profit. If below 18% lead, it is left in the mine, or, if necessary to remove for drifts or raises, is kept separate in the milling-ore dump. This dump contains several hundred tons and there are several stopes of this ore available in the mine.

Carbonate and Vanadate Ore Easily Separated

The ores consist of hard lead carbonate with some galena, and hard lead vanadates, the carbonates and vanadates predominating. These minerals are thoroughly cemented with silica, making them hard and glassy, and do not slime much when crushed. They are segregated from the primary or gangue quartz-filling from which they separate on crushing. They will consequently concentrate easily, the final product carrying from 50 to 60% lead and from 14 to 18% silica.

The carbonates on the 100-ft. level naturally carry more galena than the ores above. The galena on this level carries numerous crystals of chalcopyrite, assays higher in silver and is no doubt the primary ore which may be expected in the lower levels. The carbonates and vanadates are almost completely segregated and can easily be mined separately or can be hand sorted if mined together. In drifting one is sometimes in all-carbonate ore and sometimes in all-vanadium ore. Frequently a small streak of either may exist with several feet of the other mineral.



Lucky Bill Vanadium Mine

The ore is mined and classified for shipment in two grades, high and mine-run. They are dumped from a car at the top of the mine upon a grizzly and a sorter picks out any waste or rock that may get in from the oversize. All fines go direct to cars. Ores from the high-grade shoots go direct to cars and assay from 50 to 60%.

This deposit is the only one yet discovered in the United States wherein large bodies of lead-vanadate ores occur. These ores are sufficiently segregated from the other ores and gangue to allow sorting or mining them separately. Like the carbonates they are intimately mixed if not chemically combined with secondary silica. This, however, is a desideratum, as this condition will permit better concentration by eliminating the gangue silica without excessive sliming.[1]

A 15-ton lot of sorted ore, which was shipped to Germany, consisted of two-thirds of the highest-grade and one-third of the second-class vanadium ores, and assayed 9.16% vanadium pentoxide. This lot brought $56 per

[1] "A small production of vanadium ore was sold as such from the Lucky Bill mine near Bayard station. Specimens of the ore sent to the U. S. Geological Survey are yellow with green blotches and are peculiarly massive. In microscopic section the rock is seen to be made up of vanadinite crystals in quartz, which apparently replaces a brecciated porphyritic rock. The green color is probably due to descloizite." "Mineral Resources," Part 1, 1911, p. 950.

ton, f.o.b. Bayard, or twice the El Paso price for the same ore for lead. No pay was given for the lead in this shipment. This ore was evidently satisfactory as requests for regular shipments were made.

The Vanadium Mines Co., of Pittsburgh, Penn., with properties at Cutter, N. M., examined these ores and their metallurgical chemist determined an economical process for extracting the vanadium at their plant. The English reduction plants offer a higher price per unit for the vanadium pentoxide in a slag if the lead and silver are melted out. This would be a simple furnace process, for which plenty of iron and lime flux are at hand. The shrinkage, based on an ordinary type of slag, would produce a slag assaying in vanadium one-half as much again as the ores. Laboratory tests gave a concentration in the slag to 16% vanadium.

As a vanadium producer the large stockwork in the porphyry on both walls of the vein is important. This is more in the nature of the deposits in other New Mexico and Arizona mines, and consists of fine crystals of lead vanadates. They are of high degree of purity, but their tendency to slime would introduce a metallurgical problem quite different from the ores in the vein.

Production

The production by the Bogue & Wensley Mines Co. was worth approximately $18,000. The total production up to June, 1911, was probably between $20,000 and $25,000. The production by Ross, Larsh & Co. from Sept. 23, 1911, to Dec. 26, 1912, was 4174.11 tons, which brought net smelter returns of $50,009; average lead content, 27.72%, in addition to which one 15-ton lot of vanadium ore shipped to Germany brought $847, f.o.b. Bayard. Out of 141 smelter lots, 20 assayed between 50 and 60% lead, and 17 between 30 and 50%. All lots under 30% lead carried a silica penalty of about $6 per ton with additional freight, hauling and treatment charges of about $3.50 per ton.

The mine is equipped with necessary top construction, blacksmith shop and hoisting building complete, gasoline hoist, steam hoist, boiler, station pumps, pipe lines, buildings, etc. The accompanying photograph was taken during the early operations of Ross, Larsh & Co. The cross-section shows the formations.

Dynamite Explosion in Kennedy Mine

On Nov. 17 there was an underground explosion of dynamite in the Kennedy mine, at Jackson, Amador County, Calif. Three men were killed and one more was seriously injured. As usual in such cases, there is no telling how the thing happened.

According to the newspaper reports, each working level of this mine has a powder magazine, which is in a blind drift, remote from the shaft. Only enough powder, caps, and fuse are supposed to be stored for the day's operations. The priming of cartridges is done within the magazine. The company supplies crimpers but the miners usually employ a pocket knife.

The only thing definite respecting this explosion that is known is that a pair of miners went to the magazine to prepare cartridges and were last seen standing at the bench where the caps and fuse were kept. There were 5½ boxes of powder in the magazine shortly before the explosion. Afterward, there remained four full boxes and some sticks in an open box.

[The priming of cartridges in a powder magazine is, of course, bad and dangerous practice.—Editor.]

Fuel Oil for the Navy

Washington Correspondence

Secretary of the Navy Daniels takes up the question of fuel oil for the Navy in his annual report sent to Congress Dec. 2, and deals with it in part as follows:

I desire to recommend to Congress the immediate consideration of providing fuel oil for the Navy at reasonable rates, and the passage of legislation that will enable the department to refine its own oil from its own oil wells and thus relieve itself of the necessity of purchasing, what seems fair to become the principal fuel of the Navy in the future, at exorbitant and ever-increasing prices, from the private companies that now completely control the supply. This matter has been given thorough consideration by the department, and, while I am not prepared at this time to recommend the exact shape this legislation should take, it is my earnest wish that the subject receive immediate and serious consideration, as it is a matter, in my judgment, of paramount importance. I will be pleased to communicate further with Congress on this subject at any time it may desire. It is sufficient to point out at this time that the superiority of oil over coal for naval purposes has already been demonstrated and is no longer a matter of experiment; that Great Britain is equipping her navy with oil-burning vessels of the first class; that the English Government is already spending a total of $1,871,750 in the erection of enormous oil tanks; that, in addition, the scantily yielding oil-shales of Scotland are to be preserved for the use of the navy, and that in Mexico and elsewhere English firms are reaching out for oil fields from which to supply the demands of the English Navy. On the other hand, the price of oil is steadily creeping upward, so that today the United States Navy is paying over twice as much for its oil as it did in 1911. The only relief possible from what will be a staggering item in the expense account of the Navy in the future is in the control of oil wells, and refining of its own oil by the Navy Department. This has been clearly foreseen by the English Government, and Hon. Winston Churchill, first lord of the admiralty, recently declared in the House of Commons that it is necessary for the Royal Navy to establish refineries and handle its own oil transportation in order to secure the kind of oil it wants and reduce the burden of expense. If England, geographically handicapped, and with no large sources of supply within her own borders, has concluded that this is the wise and economic policy, how can the United States, with bounteous flowing oil wells on Government lands already existing, and with fields near to both the east and west coasts, escape the charge of willful waste of public money if it continues to purchase oil at prices which may fatten the pockets of a few oil companies, but which increases the burden of the taxpayer? With only a portion of our fleet equipped to burn oil, the Navy uses this year 30,000,000 gallons. There is every likelihood that this amount will be increased to 125,000,000 in the future. Every gallon of this must be purchased from the oil companies at their own price until Congress relieves the department by proper legislation.

The United States Navy has the enormous advantage enjoyed by no other nation, in that great oil fields exist in our own country close to the Atlantic Ocean, Gulf of Mexico, and Pacific Ocean, so that the supply of oil is assured. It is natural, for this reason, that the United States should take the lead in adopting the exclusive use of oil fuel and thereby reap the benefits of its many advantages in ship construction and in reliability of operation, a lead no other great naval power can follow with security. The great demand for petroleum and its products, however, has resulted in practically doubling the price of fuel oil in the last two years, and everything seems to indicate a further increase rather than a decrease in price. The large cost of fuel bills has thus become one of much concern to the department and to the country.

It is advisable from every point of view that the Navy should become producer and refiner of oil for its own use. By the time the Panama Canal is opened and the fleet begins frequenting the Pacific the Navy should be producing its own oil from the Navy petroleum reserves in the Elk Hills and Buena Vista fields of California, and its refinery should be in

operation. Prompt steps should also be taken to lease oil lands in the Mid-Continent fields and to erect a refinery for the supply of oil-burning vessels on the Atlantic coast. This proposed step is no new departure, for the Navy now builds some of its own ships, maintains large industrial navy yards, a gun and a clothing factory—all of which are indispensable to the supply of superior articles for the Navy, and for the control of prices from commercial concerns furnishing similar articles.

A well-digested plan for the establishment of oil-fuel tanks at various ports and strategical points has been adopted, and the tanks will be erected well ahead of the time their usefulness may be expected to begin.

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Fuel and Ore Consumption in Making Pig Iron

The annual report of the American Iron & Steel Association gives some interesting figures as to the use of ore and flux and the consumption of fuel in making pig iron during 1912. A full comparison with previous years is not possible, as only part of these figures was collected and reported before last year.

Consumption of Fuel

In 1912 there were consumed in making the 29,726,937 gross tons of pig iron produced in that year about 35,721,127 net tons of coke, about 47,022 net tons of bituminous coal, about 73,794 gross tons of anthracite coal, and about 35,436,017 bu. charcoal. The average consumption of coke and bituminous coal per ton of pig iron made with these fuels in 1912 was about 2436.5 lb.; of anthracite coal and coke mixed, about 565.2 lb. anthracite coal and about 2341.6 lb. coke per ton; of anthracite coal alone, about 2954.7 lb. per ton; and of charcoal, about 102.1 bu. per ton of pig iron made. Details of fuel consumption were not collected for previous years.

Consumption of Ore

The Statistical Bureau estimates the total consumption of domestic and foreign iron ore, ore briquettes, etc., not including mill cinder, scale, scrap, etc., in the manufacture of pig iron in 1912 at about 55,656,000 gross tons, as compared with about 43,980,000 gross tons in 1911. The average consumption of iron ore in 1912 per ton of pig iron made was about 1.872 tons, as compared with about 1.859 tons in 1911. About 850,000 tons of iron ore are also annually consumed by rolling mills and steel works.

In addition to the 55,656,000 gross tons of iron ore, ore briquettes, etc., consumed in 1912 by blast furnaces in the manufacture of pig iron about 4,319,000 tons of mill cinder, scale, scrap, slag, zinc residuum, etc., were also used, as compared with about 3,761,000 tons in 1911. Adding these figures to the ore reported gives a total consumption in 1912 of about 59,975,000 tons, or an average of about 2.017 tons of ore and other metallic material used per ton of pig iron made, as compared with a consumption of about 47,741,000 tons, or an average of 2.018 tons, in the previous year.

Of the total consumption of ore, mill cinder, scale, etc., by blast furnaces in 1912 about 92.8% was iron ore, briquettes, etc., and about 7.2% was mill cinder, scale, scrap, etc., against about 92.1% of iron ore and about 7.9% of mill cinder, scale, scrap, etc., consumed in the previous year.

The average consumption of limestone and dolomite per ton of pig iron made was 1137.2 lb. in 1912, against 1144.8 lb. in 1911. By anthracite and bituminous furnaces the consumption in 1912 was 1146.1 lb., against 1153.6 lb. in 1911, and by charcoal furnaces it was 381.6 lb. against 405.4 lb. in the previous year.

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Kern Trading & Oil Co's. Fire

After burning a couple of weeks, the gusher fire of the Kern Trading & Oil Co., at Taft, Calif., was subdued by chemicals early in November. Steam from 26 boilers had

Kern Trading & Oil Co.'s Fire

been applied but with no success. The fire was visible for 30 miles, and illuminated the country all around by night. It was a great day for the "movies," and several companies were on hand with ready-made scenarios to fit a fire-fighting scene in the oil field. Spectators came from miles around, and "an enjoyable time was had by all" with the exception of the owners. Their loss is estimated at $10,000 for every day the fire burned.

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Electric Steel Ingot Output is steadily growing in France, and increased from 13,445 tons in 1910 to 15,922 in 1912, says the "Mining Journal." Germany produced 36,188 tons of electric steel in 1910 and 74,175 in 1912. The yield of this steel in Austria was 22,867 tons in 1911 and 19,891 in 1912. Hungary produced about 2000 tons. It is proposed to put up two large electric furnaces at Triquac y Caen.

Leaching Shannon Copper Ores

By Francis S. Schimerka*

SYNOPSIS—A description of some of the results obtained in experiments made to find a practical leaching system for low-grade ore and tailings. The basic character of the ore makes sulphuric-acid leaching impossible on account of the high consumption of acid. Treatment with roasting gases gave successful results.

The problem of establishing a commercial leaching process for the treatment of low-grade ores and tailings, with which the Shannon Copper Co. is confronted, is rendered difficult by the considerable basicity of the material to be treated, resulting in a high consumption of acid per pound of copper extracted if sulphuric acid is used as the leaching agent.

In the following paragraphs will be presented the means which have been employed so far in the effort to surmount the obstacles in the way of leaching directly with acid; also some of the working results obtained in actual practice.

The investigations on the subject are by no means closed, and the publication of the information given herein is prompted by the desire to give an account of the progress of the work which is being carried on by the company in its attempt to solve a problem which holds the attention of a large part of the metallurgical profession.

The three classes of material which it is desired to treat by a hydro-metallurgical process are low-grade oxidized ores, low-grade sulphide ores and tailings from the concentrating mill. Of these, the oxidized ores—on account of the vast amount of this low-copper material owned by this company, which does not allow of profitable extraction by smelting—are the most important. Also, by virtue of their complicated nature, they present the most difficult metallurgical problem.

Oxidized Ores Basic in Character

The copper occurs in oxidized ores as malachite, azurite, and, to a small extent, as silicate, in a gangue of decomposed porphyry and altered limestone, the average composition of which is:

AVERAGE CONTENT OF OXIDIZED ORE

	Per Cent.		Per Cent.
Cu	1.90	MgO	9.60
SiO_2	40.80	Zn	1.30
Fe	16.50	Mn	0.70
Al_2O_3	8.40	S	0.55
CaO	5.80	Au, Ag	Minute Traces

From the analysis it is seen that the ore is basic, and in addition to the oxidized copper compounds contains a considerable amount of basic constituents partly soluble in dilute sulphuric acid. Consequently the consumption of acid, if the ore is subjected directly to leaching, is much greater than a profitable working practice will permit, and ranges from 7.5 to 8.8 lb. per lb. of copper leached, with a possible extraction of 81% of the total copper in the ore. Numerous tests have shown that for each pound of copper soluble in dilute sulphuric acid, 4.3 lb. of other metallic oxides are dissolved along with it. In order to overcome the difficulty, an attempt has been made to convert the copper and other bases in the ore into sulphates by cheaper methods than direct addition of sulphuric acid. To accomplish this the following process has been adopted:

Ore Subjected to Roasting Gases in Heaps

The ore, crushed to about 2-in. size and piled upon a heap of burning iron pyrite, is subjected to the action of the sulphurous acid and sulphur-trioxide gases resulting from the oxidation of the pyrite underneath. Simultaneously a solution of ferrous sulphate (the effluent liquor from the launders in which the copper has been precipitated by scrap iron) is sprinkled upon the heaps. By the reactions which take place between the roasting gases and the sulphate of iron, the latter becomes an essential factor in the process of converting the oxides and carbonates in the ore into sulphates. Under the influence of heat, air, moisture, roasting gases and iron sulphates, the reactions taking place in the ore pulp are probably of a very complex nature and can be reduced to simple equations only if their ultimate results alone are taken into consideration. Sulphur trioxide combines with the bases directly to form sulphates. Sulphurous acid and moisture forms sulphites with them, which readily change to sulphates. Interesting is the action of the ferrous sulphate, which under the influence of heat, sulphurous acid, sulphur trioxide and excess of air, is alternately oxidized to ferric sulphate, which is again reduced to the ferrous salt by the action of more sulphur dioxide. This process of oxidation and reduction may be expressed by the equations:

$$2\ FeSO_4 + SO_2 + O_2 \text{ (excess of air and catalytic action of ore pulp)} = Fe_2(SO_4)_3$$

and

$$Fe_2(SO_4)_3 + SO_2 = 2\ FeSO_4 + 2\ SO_3$$

It can be seen that in the reduction of the ferric to the ferrous sulphate a proportionate amount of sulphuric acid is set free and made available for combining with the bases in the ore. At the end of the heap-treatment period, the ore contains a considerable amount of ferric sulphate, which is an effective solvent for such combinations of copper in the ore as have escaped complete conversion into water-soluble sulphate, for example, basic sulphates, and unaltered carbonates. Water only is used for the leaching operation.

Oxide Ore Covers Burning Pyrite

Working on a practical scale, 1000 tons of oxide ore are piled upon 100 tons of iron pyrite, in circular heaps. Ore fines are used as a cover—about 1 ft. thick. The pyrite is allowed to burn but slowly over a period of from five to six months. Flues at the bottom of the heap, and old stove pipes which penetrate the layer of oxide ore and rest upon the top of the pyrite, provide the required draft for its oxidation. Of the sulphur in the pyrite, 50% is utilized for the conversion of bases in the ore into sulphates. After the pyrites cinders are uncovered, they form a valuable flux in the smelting operations.

In such places of the heap where the treatment is most effective from 85% to 96% of the copper can be leached by water alone. The difficulty encountered is to effect a

*Metallurgical chemist, Shannon Copper Co., Clifton, Ariz.

uniform treatment throughout the heap of ore by having the roast gases penetrate it in all its parts. The argillaceous nature of the gangue under the influence of moisture (from the ferrous-sulphate liquors) promotes clogging and prevents the gases from striking freely through the ore in every section of the heap.

The ore is leached in large circular tanks, 25 ft. diameter and 5 ft. high, 75 tons constituting one charge. At the bottom of the tanks, strips of wood 2 in. high and 1 in. wide, are placed at a distance of 1 in. from each other, and covered with coco matting; this provides a good filtering contrivance. No trouble arises from slime formation, the material being almost all of 2-in. size. No agitation, other than repeated percolation by means of air lifts, is employed.

Besides the copper, the leaching liquors contain the sulphates of manganese, lime, zinc, magnesia, iron in the ferrous condition, alumina, and a large amount of ferric sulphate. The presence of the last is objectionable if precipitation of the copper by iron is resorted to; on the other hand, it is a very powerful solvent for copper compounds. To make commercial use of the ferric sulphate, and eliminate it from the liquors previous to sending them into the precipitating launders, the copper solutions containing it are passed over raw oxide ores, or mill tailings; the copper in them is dissolved, and the ferric sulphate reduced to the ferrous salt by the sulphides in the tailings, or eliminated by being precipitated as a mixture of hydrated oxides and basic sulphates of iron by the bases in the raw oxide ore.

Extraction Is Good and Cost Low

From the leaching tanks the copper liquors are run into launders (with a suitable fall) 300 ft. long, 5 ft. wide, and 2 ft. deep, filled with cotton ties and scrap iron from the reduction works. The copper-free solutions issuing from the end of the launders, containing up to 3.5% Fe (9.5% anhydrous $FeSO_4$) are returned to the burning heaps by means of a pump. On account of the comparatively short run, no figures are as yet available concerning the consumption of iron in the precipitation of the copper.

Working with 75-ton charges, the extraction of copper from well treated ore ranged from 72.6% to 82.2% without the use of acid in the leaching operation. It fell, however, considerably below these figures for ore from sections of the heaps which were either far removed from the pyrite or inaccessible to the roast gases by reason of insufficient draft in their particular direction. It is expected to overcome the difficulty of a uniform treatment by resorting to a different construction of the heaps, especially by spreading the pyrite over a larger area than has been done in former operations.

The advantages of the process are: Coarse crushing, cheap installation, elimination of sulphuric-acid plant and the commercial usefulness of the ferric-sulphate solutions produced in the process in excess of the requirements for a single operation.

Sulphide Ore Roasted in Muffle Furnace

In sulphide ores the copper occurs in a porphyrytic gangue as chalcocite mixed with iron pyrite, and a small amount of oxide of copper (cuprite) and native copper is also present at times.

Approximate analysis of this ore is as shown in the table.

ANALYSIS OF SULPHIDE ORE

	Per Cent.		Per Cent.
Cu	2.37	Al_2O_3	13.90
S	3.02	CaO	2.10
SiO_2	58.60	MgO	2.38
Fe	8.90	Traces of zinc and manganese	

Silver and gold are not present in such quantity as to justify an attempt at their recovery. To convert the copper, of which, in the green ore, 27% to 31% is soluble in dilute sulphuric acid, and therefore present in oxide combination, into water- and acid-soluble form, the ore, after being crushed to pass a 40-mesh screen, is roasted in a muffle furnace, the temperature not rising above an incipient red heat. The result of the calcination is: Green ore, 2.14% Cu and 2.85% S; calcines, copper soluble in water, 1.03%; $FeSO_4$ soluble in water, 0.10%; $Fe_2(SO_4)_3$ soluble in water, slight trace; sulphur, as sulphates, 0.88%; total sulphur in calcines, 1.12%. Taking into account the shrinkage of the pulp, 1.03% copper in the calcines equals an extraction by water of 46.5% of the total Cu. By the roasting operation 30% of the total sulphur in the green ore had been rendered soluble in water as sulphates, 6.8% of the sulphur remained insoluble, and 63.2% had been volatilized.

On leaching the calcined ore with a 5% solution of sulphuric acid, 86.4% of the copper could be extracted with a consumption of 3.19 lb. sulphuric acid per pound of copper leached, an amount which is permissible in commercial practice.

It was intended to decrease the acid consumption by a more thorough sulphatization of the ore pulp, which it was thought could be accomplished by the addition of some cheaply available sulphur-bearing material, and it was decided to use for this purpose ferrous sulphate, which salt is recovered from the foul solutions leaving the tanks in which the copper has been precipitated by scrap iron. If the ore is mixed with crystals of ferrous sulphate, and the mixture calcined in a muffle furnace, the following change takes place; heat, sulphurous-acid gas from the burning sulphides in the ore, excess of air, and the catalyzing action of the ore pulp, oxidize the ferrous to ferric sulphate, which at an incipient red heat (535° C.) is decomposed into ferric oxide and anhydrous sulphuric acid; the latter becomes available for sulphatizing purposes and combines with the bases in the ore to form sulphates.

The result of a calcination carried out with the above purpose in view was that the green ore contained Cu 2.01% and S 2.58%, and to it was added 1.2% of its weight of Fe in the form of ferrous sulphate. This percentage is below the amount of iron which can be recovered as sulphate by precipitating on scrap iron the copper leached from an equal weight of ore.

The calcines contained copper soluble in water, 1.18% (57.9% extraction); $FeSO_4$, 0.14%; $Fe_2(SO_4)_3$, 0.04%; sulphur, 1.05% (as sulphate), and total sulphur in calcines, 1.29%. Allowing for a slight shrinkage in the pulp (1% of weight of ore) the sulphur balance sheet shows that of the total sulphur in the mixture of ore and sulphate of iron, 31.8% appears as water-soluble sulphur, 7.2% remained insoluble, and 61% had been volatilized.

There is but little change from the above results if the ore is calcined without the addition of ferrous sulphate. The amount of water-soluble copper had been increased

by about 11%, but the consumption of acid per pound of copper leached remained the same—3.19 lb., with an extraction of 84.5%.

None of the sulphuric acid contained in the ferrous sulphate was lost in the calcination at the temperature employed. From the small amount of iron soluble in water, it can be seen that the conversion of the ferrous sulphate to ferric oxide had been almost completely accomplished, and by parting with its sulphuric acid radical had contributed toward the sulphatization of the bases in the ore. That the consumption of acid was not decreased is explained by the fact that after the roast with ferrous sulphate, on treatment with dilute sulphuric acid a large amount of iron (and magnesia) goes into solution than is the case if the ore is calcined without the addition of the ferrous salt. It was expected that the acid consumption would be lower if the temperature during calcination is raised sufficiently to render the ferric oxide completely insoluble. In cases where this theory has been applied, the extraction was decreased, probably by the formation of insoluble ferrites during the roast.

At this point the application of some other reagent than sulphuric acid for the lixiviation of the copper had been taken into consideration, and the powerful solvent action of ferric sulphate upon copper compounds suggested its use for the purpose of provision for the cheap manufacture of this reagent could be made.

The production of the requisite amount of ferric sulphate, and the conversion of a certain percentage of the copper in the ore into water-soluble sulphate, can be accomplished in one operation by mixing the ore with ferrous sulphate and calcining the mixture at a temperature below incipient red heat, insufficient to decompose the ferric sulphate that is being formed. The ferrous sulphate is obtained by crystallization from the liquors leaving the precipitating launders, and its recovery presents no special difficulty. It is intended to increase their contents of ferrous sulphate by using the liquors, freed from copper, repeatedly in place of water on fresh charges of calcines, until the proper enrichment in iron promotes speedy crystallization.

Iron Is Lost As Basic Sulphate

The object of the calcination is now to produce the largest possible amount of soluble ferric sulphate in the mixture; the conversion of the copper into sulphate, although it is enhanced by the presence of ferrous sulphate, is of second importance, because any unaltered sulphides are effectively attacked by the ferric sulphate in the liquors. In the conversion of $FeSO_4$ into $Fe_2(SO_4)_3$ by heat and air, without supplying free acid, 40% of the iron is lost in the shape of basic sulphates, insoluble in water. If mixed with sulphide ore, however, the sulphurous acid of the burning pyrite which by the excess of air and by catalytic action is partly converted into sulphur trioxide supplies the proportionate amount of sulphuric acid needed to form normal ferric sulphate from the ferrous salt, and with proper regulation of the temperature the yield of soluble ferric sulphate reaches 80% of the ferrous iron added to the ore.

The experiments have been carried out in a small muffle furnace. The ore (passing a 40-mesh screen) was mixed with a quantity of ferrous sulphate corresponding to 2.8% Fe of its weight. This is below the amount which can be recovered from the leaching liquors of an equal weight of calcines. The temperature must not be higher than well below incipient red heat, and is best kept at about 480° C. The calcines from an ore with 2.01% copper and 2.58% sulphur, treated as above described, contained copper soluble in water, 1.20% (61.9% extraction); $FeSO_4$ soluble in water, 0.34%; $Fe_2(SO_4)_3$ soluble in water, 1.94 per cent.

The extraction of 61.9% (taking into account the increase of bulk) represents the copper present in a water-soluble sulphate proper. If the calcines are treated to twice their weight of water, a liquor carrying 0.97% Fe‴ as sulphate is obtained. Under the influence of this solvent, the leached copper, after 16 hr. digestion with cold water, amounted to 76.14%, and on treatment with 10% sulphuric-acid solution in place of water an extraction of 82.5% was obtained with a consumption of only 1.2 lb. H_2SO_4 per lb. of total copper leached.

The liquors, like those resulting from the leaching of oxide ores treated in heaps, contain an excess of ferric sulphate, and its elimination is effected by the same means as have been described for this purpose in the preceding paragraph.

Tailings Basic in Character

Tailings are the product of the concentration of sulphide ores in porphyritic gangue, and are of the following average composition:

AVERAGE ANALYSIS OF TAILINGS

	Per Cent.		Per Cent.
Cu	0.83	Al_2O_3	13.70
S	0.88	CaO	2.20
SiO_2	65.00	MgO	2.10
Fe	5.30	Au } Ag }	None

They pass through a 20-mesh screen (1 mm.) and 55% of their weight is slime (under 200 mesh). They contain much (49%) of the total copper as oxide and carbonate, directly soluble in dilute sulphuric acid. The rest of the copper is present as chalcocite mixed with iron pyrite.

The tailings are quite basic in nature, which is but little changed after subjecting them to a sulphatizing roast.

After 12 hr. digestion with cold dilute sulphuric acid of 5% strength, the raw tailings neutralize 4.8%, and after calcination 4.37% of their weight H_2SO_4 with an acid consumption of 12.6 and 10.9 lb. respectively per pound of copper gone into solution. The amount of copper which could be converted into water-soluble sulphate by roasting in a muffle furnace never exceeded 25% of its total and cold digestion of the calcined product with dilute sulphuric acid resulted in an extraction of only 63% with a consumption of 8.1 lb. H_2SO_4 per pound of copper leached. In calcination the temperature was kept well below the point at which the basic sulphate of copper is formed, or re-formation of copper oxide from the sulphate takes place. As the result of such a calcination, the balance sheet for sulphur shows:

SULPHUR BALANCE IN CALCINED TAILING

47.3% of total sulphur converted into water-soluble sulphates
13.9% of total sulphur remained insoluble
38.8% of total sulphur had been volatilized

Of the sulphur made soluble in water by the roast, 18.7% combined with copper to form $CuSO_4$ (or only 8.84% of the total sulphur in the tailings). The balance of 81.3% entered into combination with other bases to form soluble sulphates. The addition of iron pyrite in a quantity permissible for a profitable working practice, and subsequent roasting increased the percentage of water-soluble

copper to 51%, but leaching with dilute acid was accompanied by a still high consumption of acid (7.41 lb. per lb. of copper dissolved) without giving a higher extraction than 60 per cent.

Tailings Treated Like Sulphide Ores

The unfavorable results pointed toward the use of some other dissolving reagent, and it was decided to treat the tailings like the sulphide ores; i.e., roasting them with the addition of ferrous sulphate to form soluble ferric sulphate, and leach them in the liquor which is obtained on treating the calcines with water, avoiding the use of sulphuric acid altogether.

With the tailings was mixed an amount of iron sulphate equal to 1.4% Fe of their weight, and the roasting conducted well below incipient red heat. The calcines contained 50.8% of their total copper soluble in water as $CuSO_4$ and 1.01% Fe‴ as soluble sulphate. If treated to an equal weight of water, the liquor contained very near 1% Fe as ferric sulphate, which after 12 hr. digestion in the cold decreased to 0.19%; the extraction was 71.7% of the total copper in the tailings.

It is the intention of the management of this company to verify the experimental results obtained by applying them on a practical scale, with a view to ascertaining their commercial possibilities.

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The Administration of a Great Mine

Dr. James Douglas, president of Phelps, Dodge & Co., in the last bulletin of the Institution of Mining and Metallurgy, described the administration of the Copper Queen mine, in the following words:

For many years after the Copper Queen mine was opened, the technical staff consisted of a superintendent, an assistant superintendent (who was also metallurgist), a mining engineer, who did the mine surveying over the comparatively small area worked underground, with the assistance of a boy as rodman, and one chemist, who was simply competent to make determinations of copper, gold and silver.

Today the case is far different. The introduction of electricity above and underground for lighting, power and transportation purposes has involved the employment of a staff of expert electricians. The replacement of the old-fashioned steam engine by those of higher grade with compound cylinders, condensers and economizers, require the services of a very different grade of mechanics to the old-fashioned engine driver. Their higher salaries reduce, undoubtedly, the economical advantage of the machinery they install and operate, and there is a limit beyond which expenditure is not economical for equipment for only transitory use, as is so often the case in mining and metallurgical works. The chemical and physical staff cannot be omitted now that traces of deleterious metals must be detected and eliminated, and the physical properties of the metal we put upon the market, as for instance its electrical conductivity, are scrupulously watched. These are duties which have become obligatory upon every large metal manufacturing concern.

On the other hand, the utility of such theoretical advisers as the geologists rest upon a less unquestionable ground. Personally, I have the highest admiration for their skill, their accurate observation, and above all, their brilliant imagination, but I do not think they should be given too free a hand in directing exploratory work.

What may be considered our scientific staff consists at present, outside of the accounting staff and the administrative heads; at the mine of a mine superintendent; an assistant; a consulting geologist; a chief resident geologist and three assistants; three chemists; a chief consulting electrician; a chief operating electrician, and 10 assistants; a chief engineer and 13 assistants.

In the smelting department are the superintendent, assistant superintendent, and two understudies; mechanical engineer, electrician and 12 assistants; and five experts engaged exclusively in experimental work, and in the assay office a chief chemist and three assistants.

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Mining Companies and the Corporation Tax

Washington Correspondence

At an unexpectedly early date, the Supreme Court of the United States handed down on Dec. 1, the decision in the case of Stratton's Independence, Ltd., the important mining case which was certified to the court not long ago from the United States Circuit Court of Appeals for the purpose of ascertaining whether mining concerns are warranted in charging certain things to depreciation and whether they are subject to the corporation tax on the basis that has heretofore been required.

Stratton's Independence, Ltd., is a foreign mining corporation doing business in Colorado and in its contest in the lower courts it practically put before the judicial authorities three distinct questions as embodying the points at issue. These were accepted by the United States attorneys as containing the gist of the matter. They were as follows: (1) Does the corporation-tax law actually apply to mining corporations in the same sense that it applies to others having a "net revenue" from operation? (2) Are the proceeds of ores mined by a corporation on its own premises such an "income" in the sense in which that term is used under the law? (3) Supposing that such proceeds are to be regarded as income, is not the corporation entitled to deduct from its gross revenue the value of such ore in its place before being mined as a depreciation under the corporation tax?

In answering these questions, the Supreme Court renders the following responses: (1) Mining corporations are not different from other concerns in the application of the law. (2) The proceeds of ore sales resulting from mining operations conducted on a corporation's own premises are income just as is the case with any other income. (3) The value of the ore before being mined cannot be regarded as subject to depreciation and treated as such.

The decision in the case in its final form will not be available for some days. It is regarded as of very great importance inasmuch as it gives to the Government the proceeds of the corporation tax upon all companies which mine ore or coal, this being otherwise lost if the contentions of the corporation had been upheld. The Treasury Department's interpretation of the law as heretofore applied is therefore sustained, as are the findings of the lower courts. Much of the argument in the case is likely to be regarded as furnishing a precedent in other cases involving similar issues under the corporation-tax act.

Winding Accidents on the Rand

JOHANNESBURG CORRESPONDENCE

The report of the government mining engineer contains particulars of winding accidents which are of more than local interest. During 1912, there were 75 accidents reported due to overwinds or runaways; of these, 19 caused serious injury or death, and in 45 cases the certificated engine drivers were held to be at fault. The worst accident was at the New Comet mine. The skip containing 25 persons was being lowered and the steam-operated gear of the friction clutch of the drum was thrown over properly, but owing to some undiscovered cause, there was some sticking in the steam or the cataract cylinder and the clutch had not engaged (this was proved by the gear acting in the same way after the accident, but no cause could be found). The brakes could not hold the skip and it went down 3000 ft. at 52°. It is difficult to believe that even four of those in the skip escaped with injuries. The following regulation has been drafted to prevent any possible recurrence of such an accident. When the winding engine is fitted with friction clutches or drums the engine driver, when clutching in, shall test the holding power of the clutch against the engine before releasing the brake in corresponding drum, the other drum brake being off.

Winding accidents were due chiefly to: (1) By starting to lower with the reversing lever in position for raising. Phillips overwinding device makes this impossible by arranging that when the skip is at the surface, the change-gear levers and indicator make electrical connection with an electric bell, until the lever is put over in correct position for lowering. There were six cases of this mistake during 1912. (2) By changing from skip to cage, on the surface, and the engine driver forgetting that persons are being raised also in the skip. There were two cases of this mistake. (3) When lowering unbalanced with the large electric winders on counter current, and obtaining too great speed, by applying the reverse current too suddenly, which caused a failure in the resistance control of the rotor or a tripping of the switch of the stator current, with a failure of the brake to control the runaway drum. There were five cases of this accident. Four were caused by flash over in the starter tank and one by flash over at stator terminals. The application of reverse current to the descending skip has the effect of enormously increasing the voltage across the rotor terminals. The usual 600 volts goes up to 2000, periodicity increases from 50 to 150, and the liquid starter tank fails and causes an open circuit. These tanks have now been improved to stand the higher voltage. (5) By lowering on compression with reversing lever against the motion causing too much compression and slowing or stopping the skip. The driver puts the reversing lever over to the forward position and neglects to control adequately the drum by the brake, causing a runaway or a bump into shaft bottom or penthouse. There were two cases of this occurrence.

The most unforeseen accident happened at Kimberley. There were two men in the cage just below the 2520 ft. level. The native in the engine room took a lighted lamp into the pit below the winding drums in the engine house and set fire to the oil there. This heated the ropes and caused them to fail. The skip dropped and one man was killed.

Labor Conditions at Fairbanks, Alaska

BY HUBERT I. ELLIS*

The isolation of the Fairbanks district and the fact that most wage working is confined to five or six months of the year combine to make the labor problem one of great difficulty. Thanks, however, to the high wages of the district and the comparative quietness of industry in the United States proper during the last six years, there has never been a serious shortage of labor. Indications are that men will be less plentiful this season than formerly, due to the Balkan war and to increased industrial activity on the Pacific coast. It is hoped, however, that the arrival of the first through passengers from the outside will relieve the present tendency to a labor shortage.

In the placer mines there is little demand for skilled labor. With the exceptions of the hoistmen, the pointmen and the timbermen, the majority of the laborers are foreigners, chiefly Russians, Slavs, Montenegrins and Greeks. A few Italians, Swedes, Danes, Finns and other Europeans are employed principally for shoveling the thawed gravel into wheelbarrows and running the barrows to the shaft or to the car, as the case may be—work that corresponds to "mucking" in the Western metal mines. Except for the shovelers, American or Americanized labor is the rule.

WAGES NOT SO HIGH AS THEY APPEAR TO BE

At first sight, wages appear to be high, but a little analysis shows that they are no higher than is just. Shovelers and other unskilled laborers are paid $5 per day and board; pointmen receive $6 to $7 and board; timbermen, $6 to $7; dump-box men, $6; firemen, $6; hoistmen, $7; blacksmiths, $7. The wage scale is well fixed in the district, and it is only in exceptional cases that there is any variation. When it is considered that the average of employment does not greatly exceed 120 days per year, and that the men must support themselves during the long winters out of their summers' wages, it is seen that high wages are entirely justified.

All of the men in the placer mines work 10 hr. per day. In 1907, the miners' union demanded $6 per day of 8 hr.; the operators offered to compromise on $5 for 8 hr., but the union refused their terms, and a strike was called. An association of operators was formed to fight the union, for which purpose laborers were imported wholesale from the outside. The strike was lost, following which many of the members of the union departed for more attractive fields. The union, discredited in the eyes of the public because of its tactics during the strike, simultaneously passed out of existence. Up to the time of the strike, most of the men employed in the placer mines were from the mining camps of the West, but since then the foreign element imported during the strike has been in the majority. The loss of the strike was due, aside from the prompt but questionable action of the association of operators, to the unreasonable demand of the union for $6 for an 8-hr. day, and to the fact that little skill and no previous experience is required of a common laborer in a placer mine. The men are worked side by side, usually in groups of eight or more, and supervision is a simple task. During the strike, the association of operators advertised widely in the Pacific Coast cities the

*Mining engineer, Fairbanks, Alaska.

many advantages of emigrating to Fairbanks. What their statements lacked in truth they made up in color. This same performance was repeated annually even as late as the spring of 1911, with the result that many more men were attracted to the district than there was work for. This caused much hardship and suffering, especially among those that were unable to get away from the camp before the coming of winter. In 1912, however, the supply and the demand became about equal, and this year promises to witness a still greater improvement, from the standpoint of the laborer.

Losses through Failure of Mines to Pay Wages

One of the greatest evils in connection with the oversupply of labor was the appalling loss of wages through the failure of various mines to pay operating expenses. Hundreds of thousands of dollars have thus been lost to the laboring men of the camp. Most of the placer ground of the North is worked under lease, the usual royalty being 20 or 25%. All the lessee, or layman, needs is a large stock of optimism and the ability to hypnotize others into seeing visions as highly rose-colored as his own. The owner of the ground cares little whether it pays expenses as long as he gets his royalty regularly. The layman, having little or nothing to start with, feels that he has a world to gain and nothing, of his own, to lose. It was customary in the past to pay the banks and the merchants what was due them first, and to pay the workmen afterward—if there happened to be anything left. During the last few years, however, it has been recognized that the laborer is entitled to prior consideration. This has been due partly to better and more explicit laws and partly to the effect of aroused public opinion. In the last two or three years, the loss of wages in the Fairbanks district has been comparatively slight.

There is no place where men work much harder than they do in the placer mines of Fairbanks. During the short season when sluicing is possible, it becomes necessary to use every available second, and to use it to the fullest. Much of the ground worked is so low grade that the slightest let-up on the part of the laborers would cause the closing of the mine. Thus it is one continuous rush, 10 hr. per day, seven days per week. The man that cannot keep the pace is quickly found out and sent on his way, for, in the eyes of the operator, he not only fails to do the work for which he is paid, but he interferes with his speedier fellow workers. Formerly it was the custom to pay some man of exceptional strength and endurance $1 per day or more extra to set the pace. This is rarely done at present, however.

Increase in Farming Helps Miners

The men are usually as well fed as the isolation of the camp and the consequent difficulty of obtaining fresh foods will permit. The great increase in farming in the vicinity of Fairbanks in recent years has been a great help to the miners. In the bunkhouses little attempt is made to add to the comfort of the men. Not infrequently as many as 20 are quartered in a single room. Ventilation in the mine is entirely from a central shaft, though a fan is sometimes used. In some cases it is necessary to use electric lights at the face, candles either refusing to burn at all, or else burning with such a smoky flame as to be practically useless. The failure of the candles, however, seems to be due more to excessive water vapor than to the vitiated condition of the atmosphere. In view of the extremely hard work and the poor working and living conditions, it is not difficult to credit the saying of the North that four or five seasons in the placer mines renders a man unfit for hard labor during the rest of his life. While there are some men that do the work year after year without apparent harm, yet there is no denying that the average man is able to stand it only because of the short season.

Winter Spent in Prospecting

The sluicing season, which begins about May 1, is practically over by Oct. 1. By that time the last boats have departed for the outside, and the man that finds himself out of work is faced by three alternatives: He may go to the coast by way of the government trail to Chitina and the Copper River & Northwestern Ry., and take a boat from there to the States; he may stock a cabin with food and spend the winter in idleness; or he may purchase an outfit of food and clothing and put in the winter in the hills prospecting, hunting, or trapping. To the fact that so many men in Alaska choose to spend the winters prospecting is due the many discoveries of pay gravel that annually start new camps and rejuvenate the old ones.

The development of lode mining during the last three years has introduced a new factor into the labor situation. Skilled men of considerable experience are essential to successful lode mining, especially in new mines where the veins are small and irregular, but comparatively rich. It is probable, however, that at present less than 8% of the laboring men of Fairbanks are engaged in lode mines, but when it is considered that they work about three times as many days in a year as do the placer miners, their relative importance is considerably enhanced.

The skilled miners from the mining camps of the West never took kindly to the 10-hr. day. Since the unskilled foreigners that supplanted them in the placer mines were of little use in the quartz mines, it was natural that the 8-hr. day should early be established in the lode mines. Though several mines attempted to force the 10-hr. day on the men, they met with such poor success that they soon abandoned all efforts in that direction. While the quartz miners of Fairbanks work harder than the men in the average western metal mine, they do not work so hard, even leaving out of consideration the difference in hours, as the placer miners of Fairbanks.

Eight-Hour Law Probable

About a year ago, Alaska was granted territorial government. The first legislature, which met during the last winter, took up the labor problem. A bill making the 8-hr. day compulsory in all mines was introduced, but it failed to become a law. A similar bill, but applying only to quartz mines, fared better, and is now on the statute books. At the next meeting of the legislature, the same question is sure to be brought up again, and it is probable that the clauses of the bill will be extended to apply to placer mines also. In that event, the placer operators of Fairbanks plan to reduce wages to $4 and board. In view of the high cost of living in Fairbanks and the short season of employment in the placer mines, such a wage will not prove attractive to the miners. Then, it seems likely, Fairbanks will experience its first real shortage of labor.

Salted Mines

By G. L. Sheldon*

While the practice of mine salting is not as common as it was 20 years or more ago, it is still occasionally done, and in Mexico with particular skill. One of the most successful large-scale operations of this nature was perpetrated at Juneau, Alaska, about 20 years ago. The story was told to me, while on the trail in Mexico, by an engineer who had it from one of the schemers he befriended when he was dying.

Three partners owned a ledge 200 to 300 ft. wide on an island near Juneau. They had done a great deal of work in tunnels, drifts and raises, but the ore was too low-grade to make the property of any value. The owners, however, proceeded to work up a sale on a basis of a total price of $450,000, a 25% payment to be made after examination.

The prospective buyers sent two different corps of engineers, one following the other. One of the owners met the first party in San Francisco, worked into its good graces and assisted in the sampling. He was able to salt the samples so that they represented a value of $4 per ton. The second party was met by another of the owners and the same scheme successfully worked. The samples checked nicely.

Wishing to make assurance doubly sure, the purchasers sent out a third party, but the engineer in charge of this one would have nothing to do with the owners and required them to turn the mine over to him and leave the island. He took two or three tons of samples and the lot, in large sacks, was brought to Juneau and remained on the wharf for several days while waiting for a San Francisco boat, in charge of a watchman night and day.

While the samples were on the wharf, three fellows dressed as travelers or tourists, with their little dude canes, strolling around would come to these sacks, ask the watchman a lot of foolish questions about them, and all the time they would be stabbing and punching the sacks with their dude canes, which were loaded with chloride of gold. This was repeated several times, each time changing the disguise. It was so well done that the third engineer's report was satisfactory and the schemers received their first payment, all that they expected.

About 15 years ago a property on Signal Hill, Cripple Creek, within less than a mile from the town, was salted by using chloride of gold in a shot gun, shooting it into the breasts of the drifts and bottom of the shaft. It was so well done that the swindlers received the first payment, amounting to $10,000.

In boom days of a camp, it is quite common for a prospect hole to be salted with rich ore from some other mine. It was generally worked off on the tenderfoot, the practical mining man being avoided. When chloride of gold is used it can be easily washed off with water, and most of its efficiency destroyed.

About 25 years ago the Mulatos mine in western Chihuahua, Mexico, was salted for a large operator of San Francisco. The mine is a large low-grade property, having a 10-stamp mill on it.

The engineer and assistants representing the purchaser took out their own ore and ran it through the mill, made their own cleanup, with no help except the old Mexican mill man, who had always been on the property, and who looked after the machinery and oiled it.

The returns were satisfactory, the owner went to San Francisco, received his first payment of $100,000, and placing it in one of the banks there, proceeded to have a good time. He wrote and instructed his nephew, at home, to pay the old mill man 10,000 pesos. This seemed too much to the nephew, and he only gave the mill man 1000 pesos. This made the old man mad; he went to the American in charge of the mine, who was doing development work, and told him how, showing his hands, he had let his thumb and finger nails grow out long, and had filled under them, using wax to hold it there, fine placer gold. Every time he went near the battery he worked the gold out into it and thus increased the values satisfactorily.

The American in charge immediately notified the San Francisco purchaser, who obtained an injunction, holding the first payment in the bank, eventually recovering it all except a few thousand that had been joyfully spent. The old Mexican mill man was paid his 10,000 pesos, and procured a little home of his own, living at Sahuaripa, Sonora, 15 years ago when I saw him there.

Three or four years ago a large 50-ft. vein, a recent discovery in central Chihuahua, Mexico, was salted for one of our largest American operating companies. The second corps of engineers had been sent to examine it. The rock was hard and several Mexican miners were employed to assist in taking the samples, breaking them up fine and quartering them down, before being taken to the assay office. They were working under the supervision of an American.

The samples had been averaging $7 to $8 per ton, which checked with the first examination. One of the engineers, a friend who told me of it, one day put a piece of good-looking rock in his pocket and assayed it later. He got nothing and became suspicious. At night, after all had gone to bed he went to the mine alone, took a lot of samples from the main works, took them to the assay office, locked himself in, assayed them and obtained practically nothing. It was found that the Mexicans employed were paid by the Mexican owner to salt the samples, the owner furnishing cigarettes loaded with fine placer gold, the ashes being dropped into the samples.

Nine or ten years ago, when located at Choix, Sinaloa, Mexico, a 40-lb. sample of a new 20-ft. ledge was brought me by an American. We took a general sample ground fine and obtained $20 per ton, by panning in the horn spoon. Knowing well one of the Americans who had had access to the sample, we separated the coarse rock from the fines, washed and dried it, ground and horned it, obtaining practically nothing. We examined the fines with a glass and found that it showed placer gold.

Later another American, claiming to be an engineer, joined the one that salted the sample brought me. They obtained some rich samples from a mine a few miles distant, and with these the E. M. went to Boston, where he had some acquaintances, organized a company on this 20-ft. ledge, sold stock and sent some money to the American on the ground, who then located it and commenced work, doing several hundred feet. A complete 10-stamp mill was purchased, but only a part of it ever reached the mine, which was no good and would not assay $2 per ton. The E. M. stayed in Boston selling stock, the money being sent to the party on the ground, who kept it, cleaning up $40,000 and beating his partner out of his share of it.

This same party a few years previous had salted a

*Ely, Nevada.

placer in Sonora, for an American from Cripple Creek, who was sent to examine it. He assisted in the taking of and panning of the samples, thus being able to drop placer gold into them. The Cripple Creek man admitted to me later that he know the samples were salted, excusing himself by saying that the company sent him to examine only paid his expenses and $2 per day, promising a liberal stock interest contingent upon his reporting favorably. He said this was the only way he could make a dollar out of it. The company spent $28,000, took out $1200 in placer gold, and quit, neither American making anything.

Within the past year two friends, both good, practical mining men of experience, lost $7500, the first payment on a gold prospect in Sonora, even after they had sent a third engineer to check up their examination. A little work demonstrated that it was no good; had been salted.

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Chino Copper Co.

Report of the Chino Copper Co. for the third quarter of 1913 shows a production of 15,187,003 lb.: 4,893,325 lb. in July; 5,967,600 lb. in August; and 4,326,078 lb. in September. Production for first and second quarters respectively were 12,021,872 lb. and 11,990,832 lb. Average monthly production for three quarters is 4,355,523 lb.

Ore milled during the quarter was 507,650 dry tons, an average of 5518 tons per day, 47% of the material coming from the Hearst orebody.

Average copper content of the ore was 2.23% and the average extraction 66.98%, a recovery of 29.92 lb. of copper per ton of ore milled. Average grade of concentrates was 14.46% copper.

Cost per pound of copper produced was 8.41c. after allowing for smelter deductions but without making credits for miscellaneous revenue. The latter, amounting to 0.33c. per lb., would reduce the net cost to 8.08c. per pound.

Financial results for the quarter are: net profit from milling, $951,293; miscellaneous income, $43,596; total, $994,889. Deducting dividends paid, net surplus was $351,014. Earnings are based on a copper price of 15c. per lb. Copper on hand at the close of the quarter, sold and unsold, amounted to 19,540,748 lb. Unsold copper inventoried at 13.3c. per pound.

During the quarter additional first mortgage bonds were converted to the amount of $484,000, leaving only $210,500 par value of the original issue of $2,500,000.

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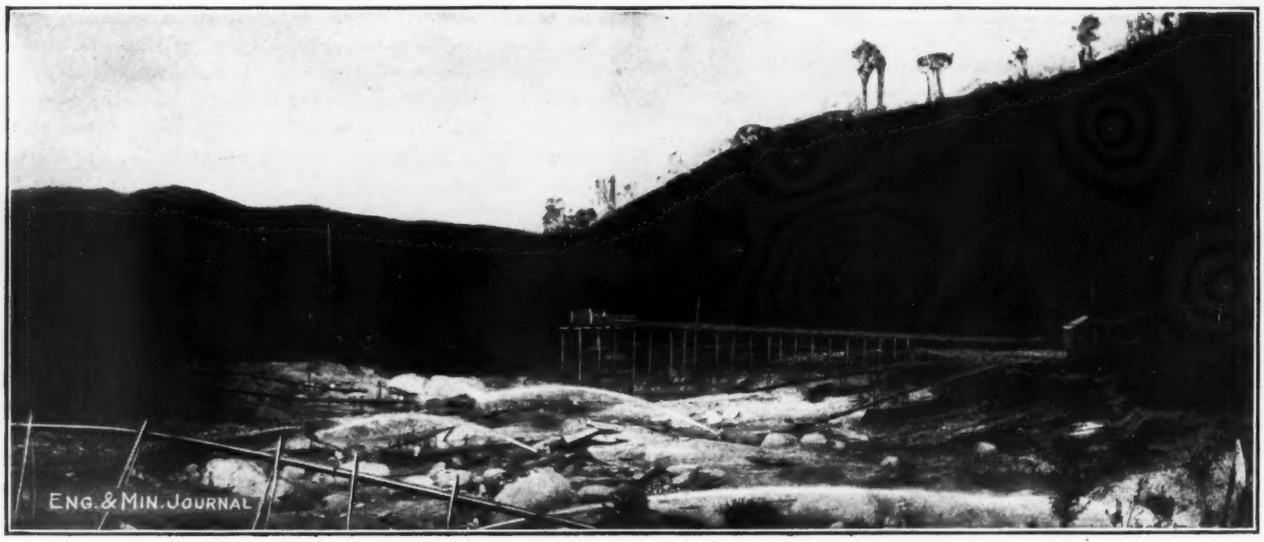
La Clara Hydraulic Mine, Colombia

Some interesting pictures are presented herewith of a successful hydraulic mine operated in Colombia, South America, by McGuire brothers, of Medellin, Colombia. This property, La Clara mine, is about 50 miles from Medellin. It has been operated for several years by the three McGuire brothers, under lease from J. T. O'Brien, of Medellin.

La Clara mine lies along the Porce River, and is so situated that it is frequently flooded during the freshets. The alluvial deposit contains boulders of large size, some of them measuring 15 ft. in diameter. Therefore, there was no possibility of dredging this property, and as the bedrock has insufficient grade for hydraulicking and no room for tailing dump, it was decided to equip the mine



LA CLARA HYDRAULIC MINE ON THE PORCE RIVER, COLOMBIA

with hydraulic elevators. The deposit varies from 18 to 35 ft. in thickness and the bedrock is hard and uneven, but the present method of working enables the operators to clean practically all this bedrock by hand and also by means of hand nozzles to wash and clean bedrock around the base of the large boulders. Some idea of the size of the boulders may be obtained by noting in comparison the men in an accompanying picture. The present equipment of the mine includes a flume about a mile and a half long, and about one-half mile of main pipeline, beginning with 22 in. and ranging down to 18 and 16 in., with 13-in. branches to two hydraulic elevators, and 11-in. branches to the monitors.

Water is brought to the property under a head of 280 ft. and the gravel is sent to the elevator pits by three No. 1 giants, which are supplemented by several hose lines used principally in cleaning around boulders and bedrock. The boulders are not blasted or removed, as in many placer operations, but the gravel is carefully cleaned out around them. On account of native labor being the only type available, the equipment as far as possible has

been kept of the simplest type. The monitors are No. 1 size, without deflectors, and with the labor available and the type of gravel, they have proved most satisfactory.

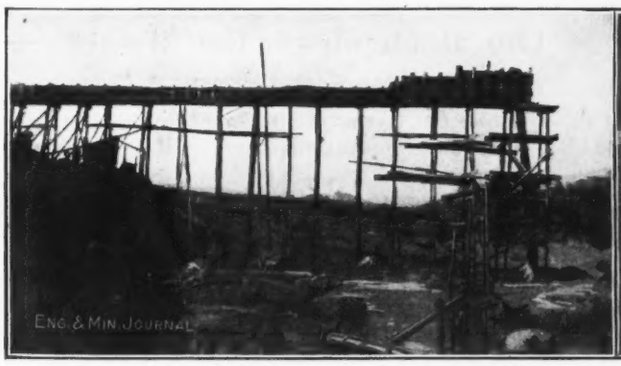
The two hydraulic elevators with 12- and 8-in. discharge, respectively, were furnished by the New York Engineering Co., which also supplied the monitors, and in fact, practically the entire La Clara equipment. The elevators are interesting in that they are equipped with manganese-steel lining plates on the wearing faces, which can be readily replaced when worn. The elevator housing and the throat housing are made of wrought steel, with all joints welded. The nozzle butt is made of forged steel and is finished all over to reduce friction of the water and gravel. The nozzle tip is made of tool steel, and the sizes used range from 1½ to 4 in., depending upon the character of the service desired; the mine being subject to flood, it is occasionally necessary to pump water before gravel washing is attempted.

CLEANING OUT HOLE IN BEDROCK, SMALL HYDRAULIC ELEVATOR PUMPING TO LARGER ONE

CLEANING THE BEDROCK AT LA CLARA MINE—MONITORS NOT WORKING

HYDRAULIC ELEVATORS WORKING IN TANDEM, GIANTS PLAYING TO LARGE ELEVATOR AND A 1½-IN. NOZZLE FEEDING THE SMALLER

LA CLARA CAMP, SHOWING THE PIPELINE, THE McGUIRE RESIDENCE AND FARM ADJOINING THE MINE



ONE OF LA CLARA FLUMES AFTER WORKING OUT THE GRAVEL UNDER IT TO A DEPTH OF 35 FT.

NATIVE MINERS IN FRONT OF LA CLARA MINE, AND PART OF THE ROCK BREAKWATER

One of the elevators that was put in service during the last year was reported upon by the owners at a certain date as having dug a hole approximately 200x300x18 ft., or about 36,000 cu.yd., without having given any sign of trouble due to wear; a great improvement over the old type of cast-iron elevator. The depth of the gravel varies frequently. When a deep hole is found in the bedrock and the elevation to the sluice is too great, the two hy-

draulic elevators are hitched in tandem with the discharge of the one leading into the suction of the other, as shown in one of the accompanying views.

Two sluices are used, one being 3 ft. wide by 18 in. high, the other being 2 ft. 6 in. wide by 24 in. high. Both of these sluices are equipped with riffle bars, consisting of 2-in. square wood strips topped by a special 2x⅜-in. cold-rolled steel strip. The riffles are spaced 2 in. apart and there is no overhanging lip, or projection of the steel top piece. These riffles have proven most efficient for this particular work. The head boxes of these sluices are all inclosed and lined with a manganese-steel striking plate on the top; the discharge from the hydraulic elevator is delivered directly against the manganese-steel striking plate. Formerly a 3-in. wrought-steel striking plate was used, which wore out rapidly, and the use of a 1½-in. manganese-steel striking plate has proved far more durable and economical.

The operating season is usually between December and April. In May the river usually becomes so high that La Clara mine is flooded and no further attempt is made to operate until the latter part of the year. The property, however, is situated in a beautiful and healthful country, at an elevation of 2500 ft., and the McGuire brothers devote themselves to the raising of cattle and sugar cane during the period of the year when "gold farming" is impracticable. They expect to erect during the coming season a sugar mill to handle the cane raised on their ranch.

McGuire brothers cleaned up about $60,000 during the 1912-13 season of about four months, operations being somewhat curtailed by litigation relating to water rights. They have operated this property successfully for several seasons, and one factor in the success has been the fact that the three brothers all remained "on the job" during the season, besides having had practical experience as placer miners in the Western United States. Since the last season's operations were completed, four more hydraulic elevators have been purchased, together with other supplementary equipment. The McGuire brothers are preparing to open another mine across the river from the present operation, and have built a wire-rope suspension bridge to carry a 13-in. pipeline to that property.

Mineral Production of New Zealand in 1912

The mineral production of New Zealand for the year ended Dec. 31, 1912, was as follows, according to the official report of the Minister of Mines, the items being arranged in order of descending values: Gold, 343,163 oz.; coal, 2,177,615 tons; kauri gum, 7908 tons; silver, 801,165 oz.; scheelite, 135 tons. Other minerals (greenstone, pumice stone, pyrites and stone) to the value of £7224 were produced. The total value of the mineral production was £3,042,224, a decrease of £450,179 from that of 1911. This decrease was due to the disastrous strikes at Waihi, Reefton and Blackwater.

Six companies are drilling in search of petroleum in the North Island. The second government bonus of £2500 was won by the Taranaki Oil Wells, Ltd., upon their producing 500,000 gal. of crude petroleum from their Moturoa wells. A refinery has recently been built for the treatment of their crude oil.

The works of the Waihi-Paeroa Gold Extraction Co. for treating tailings discharged into the Ohinemuri River by the Waihi and Karangahake mines, has given satisfactory results, which enabled the company to pay a substantial dividend. Fifteen dredges were operated on the West coast and 72 in Otago and Southland. The total production of gold from dredges amounted to £257,333, and dividends paid by registered dredging companies were £38,841.

Argo Mill's New Treatment Schedule

IDAHO SPRINGS CORRESPONDENCE

The Argo Reduction & Ore Purchasing Co., of Idaho Springs, Colo., has issued Schedule "D" covering the purchase of ores for treatment in the Argo Mill at the Newhouse Tunnel. This company's mill has been shut down on account of shortage in ore supply but is now operating, the sampling plant starting on Nov. 15. The treatment rates in the new schedule are higher than in the former schedules, because the company found it impossible to operate at a profit under the old rates.

SCHEDULE FOR PURCHASE OF ORE, F.O.B. ARGO MILL

GOLD: Pay $19 per oz., if 0.05 oz., up to 1.5 oz. per ton.
Pay $19.50 per oz., if 1.5 oz. or over per ton.
SILVER: Pay New York quotation, date of assay, for 60% of the silver assay, if 1 oz. or over per ton.
LEAD: Deduct 2 units from the fire assay and pay 25 c. per unit for the balance.
COPPER: Deduct 1.5 % from the wet assay and pay $1 per unit for the balance.
ZINC: No pay. No penalty.
SAMPLING: No charge.

TREATMENT CHARGES

Value of Ore	Charge per Ton
Up to $5.00 gross value per ton	$3.50
Over 5.00 to $6.00	3.75
Over 6.00 to 7.00	4.00
Over 7.00 to 8.00	4.25
Over 8.00 to 9.00	4.50
Over 9.00 to 10.00	4.75
Over 10.00 to 11.00	5.00
Over 11.00 to 14.00	5.25
Over 14.00 to 20.00	5.50
Over 20.00 to 25.00	6.25
Over 25.00 to 30.00	7.50
Over 30.00 to 35.00	8.00
Over 35.00 to 40.00	9.00
Over 40.00 to 45.00	9.50
Over 45.00 to 50.00	10.00
Over 50.00 to 75.00	11.00
Over 75.00 gross value per ton	12.00

Note:—Subject to change without notice. No lots less than 10 tons received.

Ore at Depth on the Mesabi

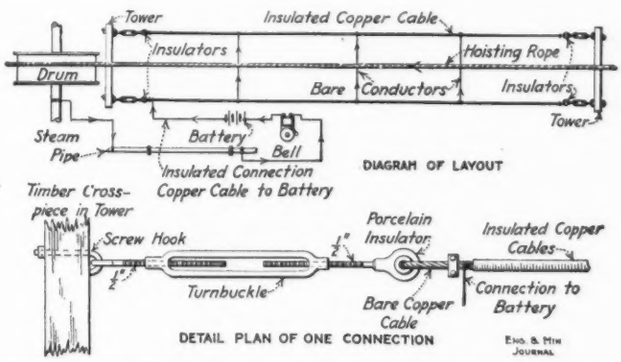
VIRGINIA CORRESPONDENCE

A well hole recently put down in the city of Virginia, on the Mesabi Range, is reported to have disclosed unsuspected features in the geological formation. The hole, something over 700 ft. deep, was drilled with a standard well-drilling outfit and since its object was to obtain a water supply, a rather careless record was kept of the formations traversed. The statement is current, however, that the hole, after passing through the green slates, encountered ore formation again, the drillings showing abundant paint rock with some layers of hematite, and that the hole was bottomed in magnetite running 65 to 70% iron. The significance of this will appeal to those familiar with the Mesabi formation. The green slate is supposed to mark the bottom limits of the ore horizon and magnetite as an ore is unknown on the Mesabi proper. The importance of the discovery depends on its authenticity and this cannot be vouched for. It is unfortunate that a better record was not kept, but it is believed that on another projected hole, arrangements will be made for thorough sampling.

DETAILS OF PRACTICAL MINING

Safety Alarm for Slack Hoisting Rope

Devices are used at the Harold mine on the Mesabi range which will automatically signal the engineer, should a hoisting rope become slack. They consist essentially of cradles of electric conductors stretched under the hoisting ropes and arranged to ring a bell in the hoist room when contact is made with a rope. The accompanying drawing shows the arrangement diagrammatically and the detail of one of the four fastenings. As is general practice on the Mesabi, the hoist is some distance from the shaft and the ropes are supported over this interval by pulleys on wood towers. Two insulated copper cables of twisted wires are stretched between two towers a few feet under each rope and about 18 in. apart. The ends of the cables are held by turnbuckles and porcelain insulators.



Several cross-pieces of naked copper wire are connected to the cables and one cable is connected through a battery to the hoist-room bell and grounded to the main steam pipe. The slack rope falling on the naked cross-wires completes the circuit through the hoist and rings the bell.

The hoist room being inclosed, the engineer cannot see what is going on at the headframe. Slack rope indicates trouble from two possible sources. The skip just dumped may get hung up, especially during freezing weather when ice and snow will often jam it; then when the engineer starts the next trip, the skip cannot pull out the rope, which becomes slack and rings the warning. Or the skip may have been hoisted too high, in which case the bottom skip lands and fails to pull out its rope and the slack rope rings the bell again. In either case the engineer will stop his engine and investigate.

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Blasting the Overburden in Winter

It is considered good practice on the Mesabi to conduct stripping operations through the winter, when possible, for the sake of holding together the mine force. Winter stripping, however, is more difficult and expensive, largely from the necessity of handling frozen ground. To minimize this difficulty, it is often advisable to keep the blasting as close behind the shovel as is safe. The reason for this lies in the fact that the blasted ground does not freeze so readily as that left untouched. Suppose the shovel to make a cut, leaving a fresh face of material behind it exposed to the weather. This, unblasted, will freeze solid before the shovel returns for the next cut and will have to be treated practically as rock. If blasted at once after being exposed, it will remain practically unfrozen until the shovel makes the second cut and can then be easily handled.

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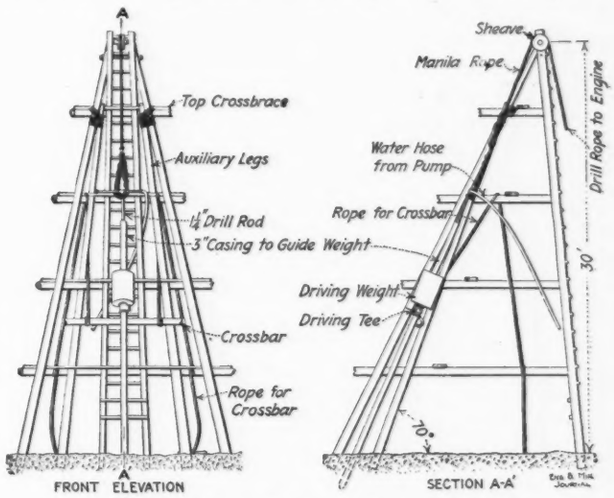
Churn-Drill Angle Holes on the Cuyuna

By Percy W. Donovan*

The Cuyuna orebodies, while more or less tabular in form, differ from those of the Mesabi in lying at steep angles, being often almost vertical. When drilling began on the range it soon became evident that vertical holes, such as has been standard practice on the Mesabi, were at a disadvantage here. Not only was there danger of



Churn-Drill Rig, for Angle Holes

missing altogether the somewhat narrow lenses of ore but also after ore had been found, misleading results were often obtained as to the amount existing.

It was clear that it would be more satisfactory to drill holes inclined in a direction opposite to the dip of the ore lenses and their inclosing formation, thus exploring a greater variety of formation with the same length of hole and penetrating an orebody of given thickness with less drilling than if a vertical hole were used. This inclined or angle-hole method is largely used at present, especially on the south range where dips are steeper. Another circumstance favorable to its use, is the fact that the formations are known to dip almost uniformly to the southeast, varying from 45° to 85°. Thus holes started to the northwest have the best chance of intersecting ore.

*Superintendent of the Cuyuna range, E. J. Longyear Co., Brainerd, Minn.

Whereas diamond-drill holes can be driven at almost any angle, the Lake Superior type is probably the only churn drill that will put down inclined holes and even its use in this connection means the adoption of special devices. This typical Lake Superior outfit differs particularly from those in use in other sections of the country in having a rigid line of drill rods from the bit to a point above the ground. The drilling tool is a chisel bit on the end of a hollow bar, with a perforation on each side a few inches above the cutting edge, which gives the drilling water a passageway from the inside of the bar to the hole. To the tool are screwed successive lengths of 1-in. or 1¼-in. pipe, extending to a point above the casing and constituting the drill rods. The only rope used runs from the end of these rods over the sheave to the engine.

The rod end is also connected by a hose to a boiler-feed pump, which forces water to the cutting edge and washes out the cuttings through the casing around the rods. Drilling is performed by tightening and slacking the rope on the capstan head of a constantly running engine, thus alternately raising the bit and allowing it to fall, the operator meanwhile rotating the end of the rods. Casing is always used; it is driven with a cylindrical weight which strikes on a tee screwed to the top of the casing; a short length of casing extends up from the tee and serves as a guide for the striking weight which slides along it. In general, a hole is begun with 3-in. casing and finished with 2-in.

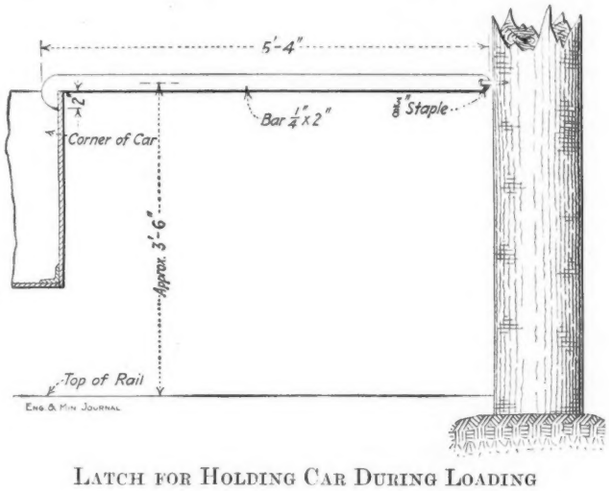
The particular feature in angle-hole drilling to which it is desired to call attention here, while simple, has resulted in a great saving of time and increased efficiency in operation. It consists in the use of two auxiliary legs or poles on the front of the tripod, as indicated in the accompanying illustration. The tripod itself may be set up in the ordinary way, the position and angle of the legs being so disposed as to give the necessary stability and the proper line for the rope over the sheave. The two auxiliary poles are then set up and their upper ends lashed to the tripod legs at the highest of the crossbraces. They are placed to stand at whatever angle it is desired to start the hole. A crossbar is hung on the face of the poles. It is notched in the middle and the 3-in. casing is leaned against it, fitting in the notch. The lower ends of the ropes which hold this crossbar are fastened within reach of the helpers on the ground so that the bar can be quickly lowered or raised as the position of the casing demands. Since the auxiliary legs stand at the correct angle for the hole, the casing will be maintained at its proper angle, no matter where the crossbar is held. When the first 20-ft. length of casing is to be started, the shoe is placed at the point designated for the hole and the upper part is leaned against the crossbar, which is hung about one-third or one-quarter of the way down from the upper end of the casing. As the casing is driven, the bar is lowered and the operation is repeated for the successive lengths.

The advantages thus secured are as follows: (1) Time is saved in setting up the tripod, the main legs being independent of the weight of the casing and its exact angle so that less care in adjustment becomes necessary; (2) greater stability in the set-up is obtained; (3) the correct angle of hole is always maintained above the ground, thereby lessening the danger of deflection below the surface; (4) most important is the fact that the chopping rods do not bind and their action is unimpeded.

It is interesting to note the increased skill and efficiency of the drill men themselves in getting down these angle holes. They were nearly all recruited from the Mesabi range, where their experience had been confined entirely to vertical holes. Accordingly, when drilling was first assuming importance on the Cuyuna range, about seven or eight years ago, angle holes were regarded by the men, and to a certain extent by the contractors themselves, with some apprehension. The rate of progress was 6 to 8 ft. per shift for surface drilling and a depth of overburden of 140 to 150 ft. was considered the limit through which it would be practicable to attempt to sink with angle holes. In fact, the 3-in. casing not infrequently became hopelessly stuck at depths not exceeding 100 ft. Increased experience with the ground, however, and the adaptation of methods to conditions was not long in developing much higher efficiency, until at the present time angle holes are sunk through 200 ft. of overburden quite as a matter of course. Not infrequently the 3-in. casing has been driven through 240 ft. of overburden at the rate of 12 to 15 ft. per shift for the entire distance.

Latch for Holding Car During Loading

At the Kennedy mine on the North Cuyuna range, the device herewith represented is in use for holding cars while loading from a chute, in cases where the grade might otherwise cause the car to run away. The drawing



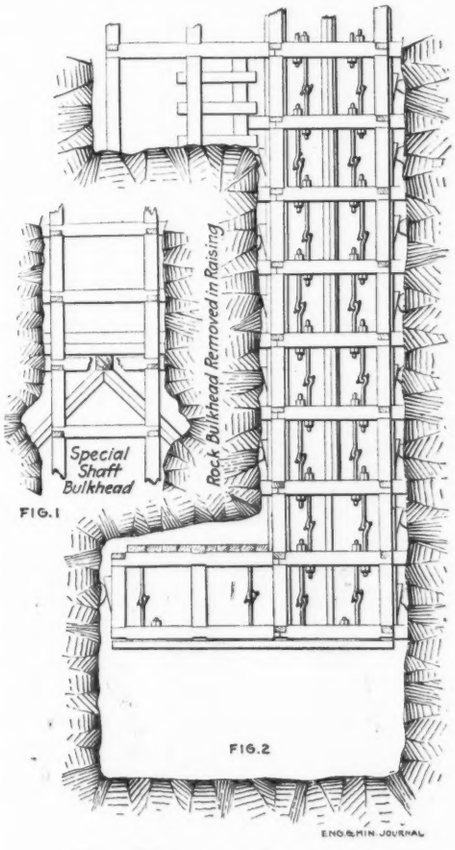
LATCH FOR HOLDING CAR DURING LOADING

is an elevation taken diagonally across the drift. The bar is held to a drift post by a staple and is of such a length that when it is caught in a corner of the car, the latter is properly positioned for loading from the chute.

A Red Light Signal for the Hoisting Engineer is provided at the Kennedy mine on the north Cuyuna range, to serve as a memory help. A red electric bulb is placed in front of the engineer's stand in line with the center of the drum. At the end of a trip the reverse lever is supposed to be always thrown over. This operation flashes the red bulb and thus impresses itself on the engineer's memory. It is well known that overwinding accidents are often caused by the fact that the engineer thinks he has thrown his reverse for the next trip, when, in fact, he has not, so that on starting he pulls the conveyance at the shaft collar up into the sheave. The use of a simple device like this ought to help to prevent such accidents.

Types of Shaft Bulkheads

Shaft continuation is always likely to be going on at several shafts in Butte. Bulkheading is, of course, universal in such cases. Usually a bulkhead is extended under the hoisting compartment of the working portion of the shaft and at a point several hundred feet above in the auxiliary compartment, through which the sinking is conducted ("Bull. A.I.M.E.," August, 1913.) Between these two bulkheads a vertical lining of 2-in. or 3-in. plank is run, separating the two portions of the shaft. The bulkhead is often made by crossing a shaft



TWO TYPES OF BULKHEADS

with several layers of 10x10-in. timber, removing the shaft lagging for several sets above this point and filling the entire space with rock. A specially framed bulkhead is shown in Fig. 1. Another good method is to leave a block of ground, as shown in Fig. 2, for about 30 ft. under the hoisting compartment of the working portion of the shaft. and then take this out by raising when the shaft is finished.

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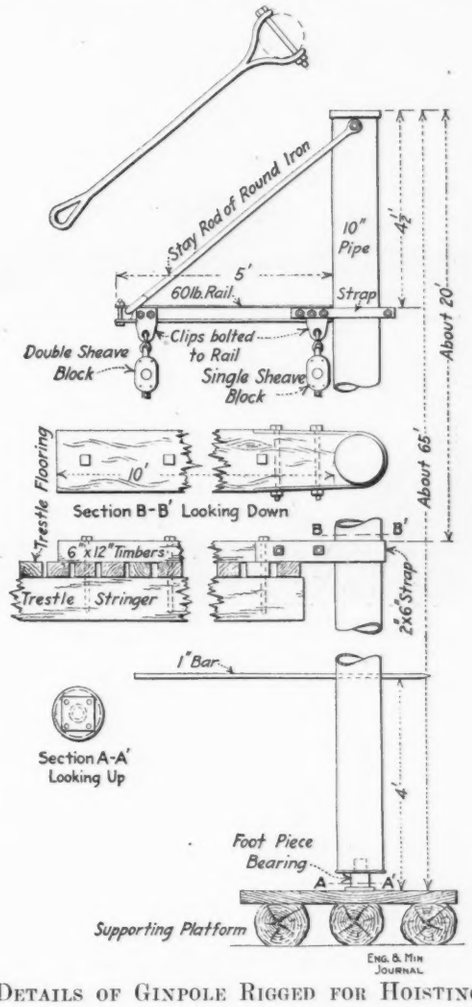
Machine Drilling in a Caisson is carried on under rather unusual conditions. With the caisson itself under a pressure of, say, 40 to 60 lb., if compressed air were piped in at the ordinary drilling pressure of 90 lb. and exhausted into the caisson, the net working pressure would be only about 45 lb. If the drilling pressure were only about 75 lb., as frequently is the case, the working margin becomes still less. The same or greater pressure is obtainable, by using the caisson air itself for the machine and exhausting to the atmosphere. This was the method followed in at least one of the concrete drop shafts put down on the Mesabi, when material was encountered which required drilling. The machine inlet was merely opened to the caisson air and a long pipe carried the exhaust through the caisson top to the outside. This method obviated the necessity of generating compressed air of a higher pressure than that required for caisson work but a machine drill with cylinder especially proportioned to the pressure was required.

Ginpole of 10-In. Pipe

A ginpole used by the Oliver company in the Chisholm district in constructing its stockpile trestles is herewith illustrated. It is built of 10-in. pipe reinforced against possible buckling by pieces of round fir about 3 ft. long inserted three to a length of pipe and bolted to keep them from slipping. The stockpile trestles run from 40 to 50 ft. in height usually and the ginpole will reach perhaps 20 ft. above the floor of the trestle. About 5 ft. from the top a horizontal arm is rigidly attached; it is made of a stout T-rail and is held to the pole by an



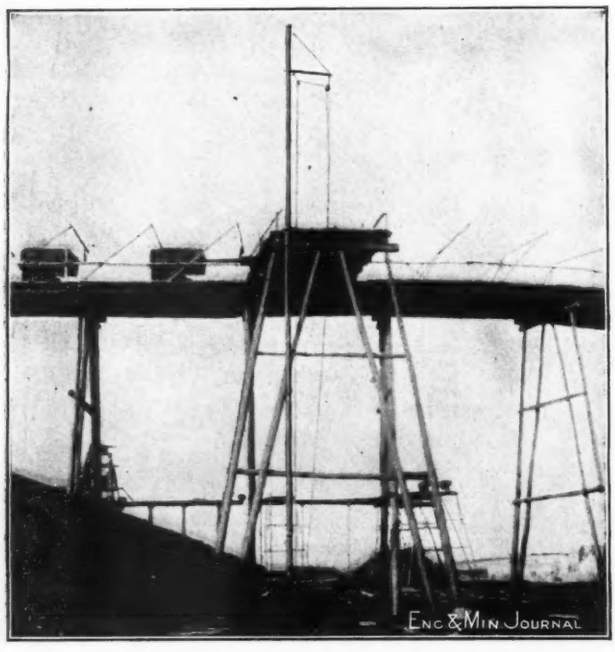
DETAILS OF GINPOLE RIGGED FOR HOISTING

iron strap and also by an inclined stay-rod of round iron, yoked at the top to embrace the top of the pole, to which it is bolted, and looped under the head of the rail at its lower end. The web of the rail is cut away to permit this looping and the head and base held together by a bolt. Near each end of the rail a clip is bolted, the upper part being a clevis to embrace the web and base of the rail and the lower part pierced to allow blocks to be hung. One double and one single block are used for hoisting.

About 20 ft. down from the top the pole is held against the trestle by a horizontal timber, 6x10 in. in section and about 10 ft. long, tapered somewhat at the end next the pole and framed to fit the pole; the bearing is completed at this point by a ½x6-in. strap bolted to the timber and passing around the pole, thus permitting rotation. The timber is fastened to the decking of the trestle.

The lower end of the ginpole is closed with a plate having a hole in the center to fit a foot-piece bearing. This bearing piece is a casting with a square base containing four bolt holes and a vertical cylindrical portion. About 4 ft. above the bearing two opposite holes in the pipe permit the insertion of a bar with which the pole is turned on the bearing described. A rough supporting platform is built of heavy planks and hewn timber.

This ginpole is not used for erecting the trestle bents which are framed on the ground and hoisted with a



GIN POLE IN SERVICE AT END OF STOCKPILE TRESTLE

wooden pole, but a great deal of material goes into the trestle, such as flooring, rails, railings, trolley-wire supports, etc., and there is no way of getting this up from the ground except by the use of some special device, since the shafts are not equipped with cages and the skips are inconvenient as well as being usually otherwise engaged. The details of the pole are shown in the drawing and a pole in position at the end of a trestle, in the halftone.

Sand Filling of Mines

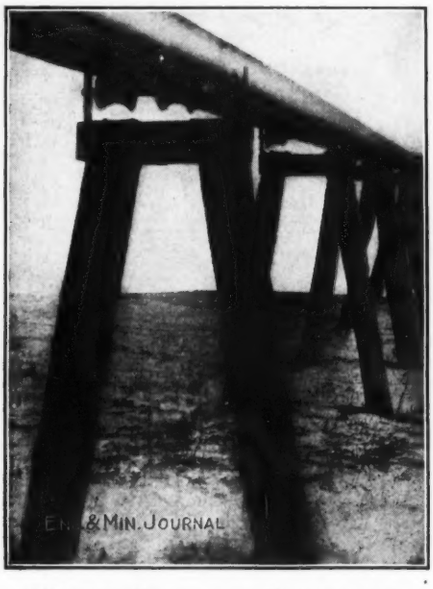
In the annual report of the Central Mining & Investment Co., Johannesburg, S. A., H. F. Marriott states that in 1912, on seven mines of this group, 984,650 tons of sand were lowered into worked-out stopes for filling. The system of operation, described by W. A. Caldecott, in Journ. Chem., Met. and Min. Soc., S. A., September, 1913, consists of transporting sand residue to a cement bin at the shaft head and sluicing it through a pipe into the stopes to be filled.

Usually only dump sand was used because of the presumable danger of poisoning by cyanide contained in fresh tailings, but experience has shown that with proper precautions current sand residue can be employed without danger, and is, in fact, preferable. The use of dump residue usually necessitates the use of considerable lime to neutralize the sulphuric acid formed by the weathering of pyrite, as well as the cost of loading and transporting from dump to shaft. Older dumps also contain considerable amounts of colloidal slime which is undesirable in material deposited underground.

Current residue is already moist and is more easily and cheaply transported to the shaft and sluiced underground. The danger of poisoning from cyanide, either in water or as a gas, is practically obviated by proper procedure, and so conducted is considered quite safe. Such methods are now being widely practiced.

Supporting Bents for Steam Line

Certain conditions at the Pettit mine on the Mesabi range made it necessary to locate the power plant some distance away from the shaft. A 5-in. and a 4-in. steam line for the pumps and a 4-in. return water line are carried over this interval on supports as shown. The bents are of varying height according to the ground, the higher ones with battered posts, the shorter with straight. The posts are of 8-in. round timber and the caps are 6x6x26 in. The posts shown have a batter of about one in seven. To the end of each cap two brackets of $\frac{5}{8}$x2$\frac{1}{2}$-in. iron are fastened by lagscrews as shown, the upright portion being about 8 in. high. These support a transverse piece of 1$\frac{1}{4}$-in. round iron on which three rollers are threaded. The rollers are 5 in. in their greatest diameter and 5 in. long, with the faces curved to fit the pipe approximately.



WOODEN BENTS AND ROLLERS FOR LONG STEAM LINE

The round bar is held in the brackets by cotters through holes in the ends.

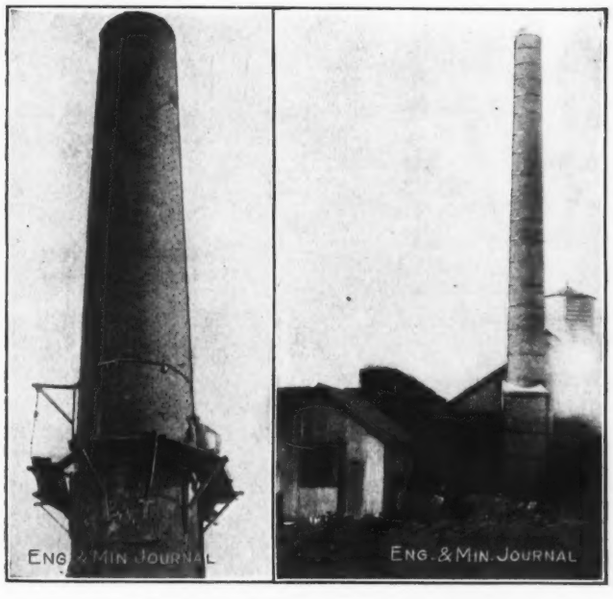
The lines are about 1000 ft. long but have no other provision for expansion than the bends at the three turns that are made. It will be noticed that the rollers permit lateral motion as well as longitudinal so that the necessary movement at the corners is possible. The two steam lines are jacketed in insulating material and painted. The water pipe is bare but is painted, as is the other iron work and the bents as well.

As a Site for the Proposed Government Armor Plant, the old works of Milliken Bros. on Staten Island are being urged for consideration.

DETAILS OF METALLURGICAL PRACTICE

Repairing a Cracked Chimney

The brick chimney at the Monroe mine on the Mesabi was struck by lightning and cracked for some distance down from the top. While the crack did not threaten the immediate destruction of the stack, it permitted the smoke to issue near the top, blackening the outside, as can be seen in Fig. 1. The management felt some anxiety as to the stability of the structure and decided to have it repaired. The job was done by the Custodis company, the original builders. It consisted of closing the crevice with new material and binding the chimney from top to bottom with iron straps. The method of work, while not unique, is interesting. The man engaged in the task worked from a platform supported on eight



THE CRACKED AND REPAIRED CHIMNEY

wood brackets, as shown in Fig. 1, the brackets themselves being hung from a cable thrown around the stack. Wire rope, ¾ in. in diameter, was used for this and was wedged out from the chimney so as to be tight and at the same time permit the brackets to be hung with the iron hooks attached to their necks. The bottoms of the brackets were also wedged out so that the slant of the top pieces was toward the chimney, thus making the platform somewhat more safe. A duplicate cable was placed above the one supporting the platform and on this was hung another bracket with a block for hoisting material. After the work at one point was finished the brackets were lifted off the lower cable one at a time and hung on the upper, the platform raised to the new level and the lower cable changed to a point above the other. The top of the chimney was reached in this way. The bands are spaced 6 ft. and are of ½x3-in. iron, made in three sections and bolted together for convenience in handling. Fig. 2 shows the chimney completely repaired. It is now equipped with two lightning rods tipped with platinum.

❋

Safety Rules—Tracks, Cars, Trestles, Etc.*

(1) All railroad crossings shall be planked over.

(2) When possible, all material shall be piled at least 4½ ft. from the track. Where this cannot be done, a sign should be provided, "No clearance for man on side of car."

(3) Scrap and other material should be kept cleaned up when lying along track.

(4) Litter boxes should be placed, wherever necessary, to keep the plant clean.

(5) All switches, guard rails and frogs should be blocked.

(6) The levers on switch stands should be thrown parallel with the track if possible.

(7) Wires, etc., should be placed at least 22 ft. above tracks, or tell-tales should be provided.

(8) Suitable bumpers should be placed at the ends of all stub tracks and track ends should be elevated.

(9) Tracks should be located, wherever possible, so as to give at least 4½-ft. clearance between the rail and any obstacle.

(10) Doors should not open out on the tracks; wherever doors do so open out, they shall be provided with a safety gate or otherwise guarded.

(11) Railings should be provided on walls along depressed tracks, provided they do not interfere with loading material on cars.

(12) To prevent persons from stepping on tracks in front of moving trains at corners of buildings, and all other places where vision is obstructed, a guard rail should be erected.

(13) There shall be placed a blue flag (or at night a blue light) at the end of all cars where men are working. Care should be taken in loading material on cars to see that no portion will project over the sides or fall off in transit. See that the weight of the load is properly distributed on the cars and that large pieces are braced to prevent shifting.

(14) When dropping cars on inclined tracks, great care should be taken to see that no one is struck by the car. Warn all persons and keep a good lookout ahead.

(15) Test all brakes before dropping cars and do not use pipes to turn brakes when riding at the front end of a car, as there is danger of the pipes slipping and throwing you in front of the moving car; use a rough stick for this purpose. If a brake is defective, never attempt to ride on the front end of a car; get off the car as soon as possible.

*From Inland Steel Co.'s book of rules.

(16) Where cars are liable to run down inclined tracks or where men are working in cars on tracks, a stop device to fit on rails should be provided.

(17) All locomotive engines should be equipped with headlights at each end.

(18) Suitable fenders should be provided on push cars, transfer cars, etc., to prevent men from getting their feet under the wheels.

(19) When opening cars, exercise great care that the dumping lever does not fly and strike you. Do not block up side-dump gondola-car doors, as they may fall and strike you.

(20) Keep off all railway tracks, except at regular crossings provided for that purpose. Use great care, before crossing any tracks.

(21) Guy lines must not be fastened to railroad tracks until after the switches are spiked on the tracks and the tracks abandoned. All guy lines fastened near tracks must be carefully examined to see that there is 4½ ft. side clearance and 22 ft. top clearance for passing trains.

(22) Trestles should be equipped with walks, the outer edge of which should be at least 6 ft. from the rail and extend to within 4 in. of ends of ties, wherever practicable.

(23) Wherever there is a driveway or passageway under a trestle, it should be completely covered over at that point.

(24) Substantial bumpers should be placed at end of all trestle tracks.

(25) Do not work under overhead trestles when they are in use and keep from under them as much as possible.

A New Bromocyanide Reagent

A new reagent for generating bromocyanide and similar haloid compounds without waste of either cyanide or halide salt is proposed by Hans Foersterling, of the Roessler-Hasslacher company (U. S. pat. 1,076,006). He melts sodium cyanide and bromide (to take a specific case) in equal molecular proportions. There is no loss or decomposition in this process.

The solidified reagent, thus produced, is then used for the production of bromocyanide by treatment in acid solution with a soluble peroxide (hydrogen peroxide may be used).

$$NaBr + NaCy + H_2O_2 + H_2SO_4 = BrCy + Na_2SO_4 + 2\,H_2SO_4$$

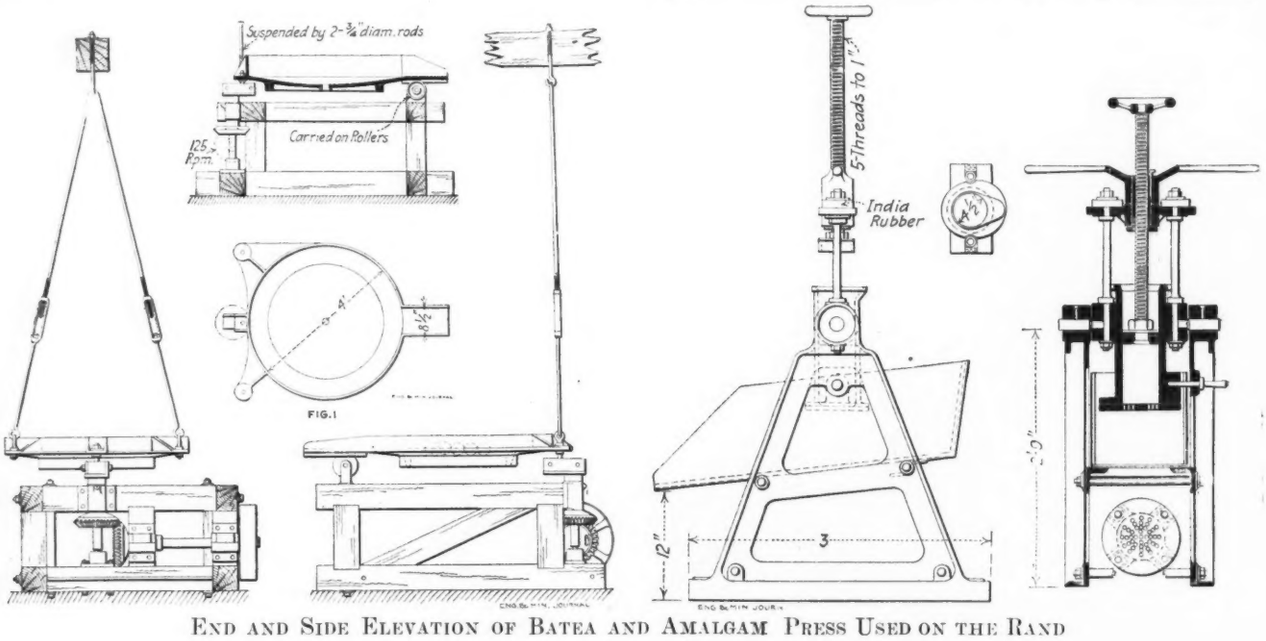
An alkaline solution cannot be used, since

$$NaBr + NaCy + H_2O_2 = NaBr + NaCyO + H_2O$$

The new reagent avoids the difficulty of the old bromocyanide process, of loss of reagent due to unintelligent mixing.

A Batea and Amalgam Press

Several devices have been gotten up for cleaning and squeezing the amalgam taken from the copper plates of gold mills, wherein the pulp is subjected to amalgamation at any stage in the process of ore treatment. Perhaps the most common device for softening and cleaning this amalgam is the cylindrical amalgam barrel. In Australia the Berdan pan is in great favor for this work, and is also used in many mines in the United States, such as the North Star in California.



END AND SIDE ELEVATION OF BATEA AND AMALGAM PRESS USED ON THE RAND

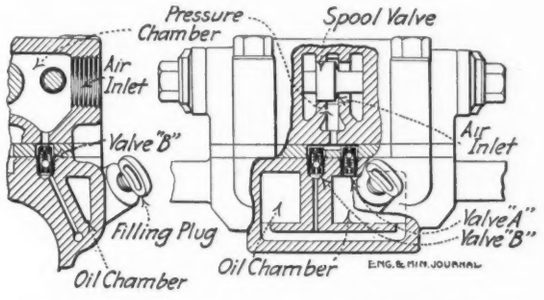
In the gold mines of the Rand, the batea is sometimes used for cleaning amalgam, but it is not frequently seen in the gold mines of the United States. The batea there in use is described by C. O. Schmitt, in "A Textbook of Rand Metallurgical Practice," Vol. 2, and is illustrated by the accompanying drawing. The only feature calling for remark about this batea is that rim of the pan is made rather higher than usual. The motion of the batea is obtained from a crank driven through a set of bevel gears by a countershaft. The usual speed of the crank is 125 r.p.m. It is usual to suspend the batea as shown in the accompanying illustration.

After softening and cleaning the amalgam from the plates, either in an amalgam barrel, Berdan pan, or batea, some sort of press is necessary for squeezing out the excess mercury. This is also illustrated above.

MINING & METALLURGICAL MACHINERY

Automatic Air Drill Lubricator

The accompanying drawing shows sections of a new pulsation lubricator applied by the Sullivan company to its latest piston-drill models. The device consists of an oil chamber cast in the top of the cylinder shell below the valve chest, from which the lubricating oil is sent to the valve by the pulsations of the actuating air, and thence to the cylinder of the drill. The chamber is connected with the valve chest by means of two small valves



SULLIVAN PULSATOR OILER FOR PISTON DRILLS

A and *B* screwed in the top of the cylinder shell. The method of operation is as follows: When the spool valve of the machine reaches its middle position the inlet ports to both halves of the cylinder are cut off for an instant and the pressure in the chamber surrounding the valve undergoes a momentary rise. The spring of valve *A* is so adjusted that this increase in pressure overcomes its resistance, depressing the ball from its seat, and permitting the injection of a small amount of highly compressed air into the oil chamber. When the spool valve reaches the end of its stroke, uncovering the port to one side of the cylinder, there is rush of air from the pressure chamber of the valve to the cylinder, which lowers the pressure in the valve chamber to such a point that the spring in valve *B* is overcome by the pressure of the air previously admitted to the oil chamber, allowing the ball in this valve to rise from its seat, and permitting the passage of a small amount of oil to the pressure chamber of the valve, whence it is distributed to the cylinder of the drill.

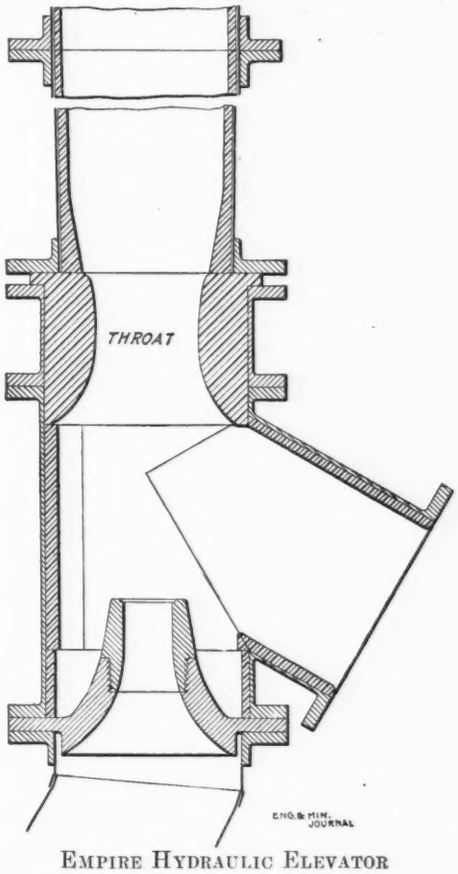
This would seem to be a compact, simple, reliable and theoretically correct method of lubricating air drills. The amount of oil admitted varies directly with the amount and rate of drilling, which is not ordinarily the case with automatic lubricators. The springs in the valves *A* and *B* are so adjusted as to work satisfactorily for a variation in pressure of 15 lb. in the air employed. The oil chamber will hold about a pint of lubricant and is filled through an opening stopped with a thumb plug, which is so placed as to permit filling whether in horizontal or vertical position.

The use of a valve of this type ought to be conducive to speed and economy, and besides relieves the operator from the bother of attending to the lubrication.

Empire Hydraulic Elevator

Where the alluvial deposit lies below the general drainage level of the country, or where the grade is insufficient to provide room for stacking the tailing, the hydraulic elevator may be used with success. It is also applicable where the ground contains exceedingly large boulders and the bedrock is too hard and rough for dredging. An ample supply of water, however, is essential.

The elevators are generally arranged in a sump cut in the bedrock, and the gravel from the bank is washed



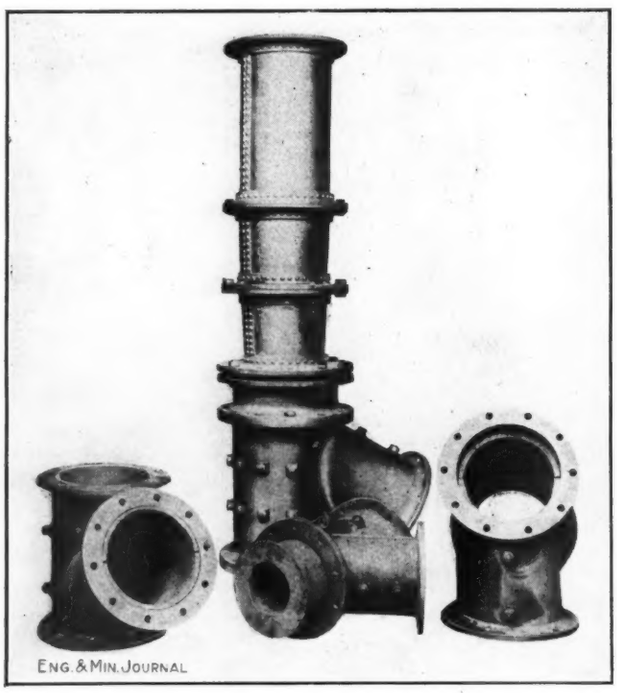
EMPIRE HYDRAULIC ELEVATOR

by monitors through a ground sluice to this sump. The elevators pick up the gravel and water from the sump and raise it to the sluice box. This leaves the bedrock exposed, so that it may be readily cleaned by hand; exceptionally large boulders may be left in place and the bedrock around the base can be cleaned with a small hand nozzle.

The hydraulic elevator consists of a tube into which a jet of water is introduced under pressure; the velocity of the moving mass of water from this jet acts on a larger body of water introduced at the suction end of the tube and causes it to be discharged at the other end with force sufficient to lift it to a certain height, proportionate to the pressure and volume of the jet stream. This mass

of moving water with its great velocity will carry along with it a certain proportion of sand and gravel, including any large stones that can pass through the suction.

Sand and gravel are an ideal abrasive material, therefore one of the principal points in the design of an elevator is to overcome or take care of this excessive wear. Another point is the matter of efficiency, which must be carefully regarded. The shape of the interior must permit the large stones that enter the suction to pass through the elevator without clogging. The ready renewal of wearing parts in the elevator is another feature. All of these points have been carefully considered in the designing of the Empire hydraulic elevator, built by the New York Engineering Co., of 2 Rector St., New York.



EMPIRE HYDRAULIC ELEVATOR, SHOWING STEEL LINING

The body housing of the Empire elevator is made of ¼-in. steel, and all the forged-steel flanges, as well as the suction branch, are connected by welding. The flanges are faced true with the body after welding. The throat housing is made in the same manner. Welded housings combine the advantages both of the cast and riveted housings without having their defects. The nozzle butt, which is bolted to the lower flange of the body housing, is made of a rolled-steel forging turned and polished on the inside. This construction affords strength and because of the absence of blow-holes or other imperfections inherent in most cast nozzle butts, it will resist wear and thus retain its most economic shape for a long time. The nozzle tip is attached to the nozzle butt by means of a coarse thread (four threads per inch), and is made of tool steel hardened in oil; the inside is polished and the discharge edge of the nozzle is counterbored to prevent chipping of this edge and consequent "brooming" of the jet. Around the circumference, at the top of the nozzle tip, holes are drilled for insertion of a spanner wrench or bar.

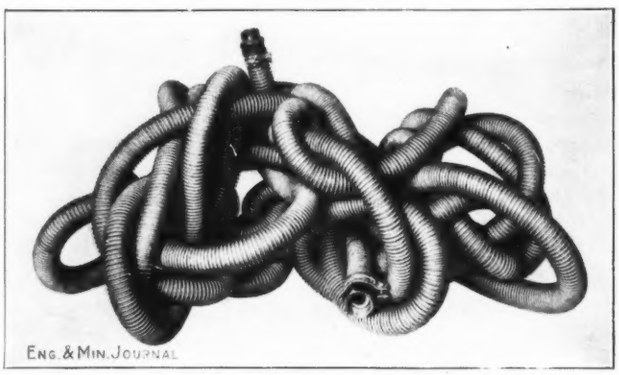
The throat is a solid manganese-steel casting of such shape as to give greatest hydraulic efficiency, but at the same time to prevent the jamming of material at the throat. The throat piece is held in position by means of a projecting flange between the top flange of the throat housing and the bottom flange of the discharge reducer.

The lining of the body of the elevator consists of manganese-steel liner bars which may be reversed and interchanged when worn. They are fastened by means of square-head countersunk bolts, countersunk on a bevel the entire thickness of the liner bar. The washers under the nuts of the bolts on the outside are milled cylindrical to fit the housing. The liners in the suction branch are two half-cylindrical shells made to fit the intersection line of this branch and the vertical housing. They are kept in place by means of countersunk bolts, in the same manner as the body liners. The construction is shown in the accompanying illustrations.

The reducer housings are riveted up in sections and are lined with manganese-steel half shells, fitting tight into same, no other means of fastening being necessary. This lining extends four to eight feet above the throat, varying with the size and the duty of the elevator. The uptake pipes are made in 4- to 8-ft. sections; the flanges of the uptake pipes are fastened by calking or peening the pipe end into a recess in the flange. This method results in obtaining the same thickness of wall at the flange connections as in the rest of the pipe, and also assures a proper butting of the uptake sections. None of these advantages can be obtained by threading the flanges and the pipe or by riveting the flanges to the pipe. When the uptake pipe is worn out, the flanges can be easily detached and used again.

Kantkink Metallic Hose

Kantkink flexible metallic hose is a radical departure from the regular protected hose introduced by the Goodyear Tire & Rubber Co., Akron, Ohio. It is a high-quality hose with an almost indestructible armor of high-carbon wires so interlocked as to admit of marvelous flexibility and great strength. One may tie a length of



SECTION OF KANTKINK HOSE

Kantkink into the fantastic series of knots shown in the picture presented herewith without sign of injury whatsoever. Of course, it can be injured by willful abuse, but not in actual service. There are no sharp, rough edges, and it cannot be kinked.

Service tests have shown its ability to withstand a pressure in excess of 1000 lb. per square inch. Kantkink flexible metallic hose is exceptional in rendering service for compressed air, air drill, flue cleaner, gas, spray, pneumatic tool, boiler, test water and steam.

Assay of Gold and Silver by Iron-Nail Method

By E. J. Hall[1] and C. W. Drury[2]

SYNOPSIS—A report on a series of tests on the accuracy of the iron-nail method of assay. The conclusion is reached that with high sulphide sulphur, the silver loss is excessive on all ores, the gold loss too great on rich ones. On gold ores under 1 oz. the method seems generally applicable.

The advantages and shortcomings of the nails method of assaying are more or less appreciated, but there is no available data on its accuracy under varying conditions, and the following results of experiments conducted in the Department of Metallurgy, Columbia University, are presented to elucidate this point.

It is well known that the fusion obtained in the lead assay is far more satisfactory than that in the nails method for gold and silver. The principal difference in the charges, as a class, is the presence of much reducing agent in the lead charge and a limited oxidizing action of the nails charge, due to PbO. The possibility of improving the nails fusions by simulating the lead charge was the reason for using argol in some tests, even though there were reasons for expecting this would have an objectionable effect on the results.

Experiments on Prepared Material

The gold- and the silver-bearing material for these tests was prepared by impregnating cupels, made from pulverized quartz, with gold and silver solutions and then converting the gold to the metallic, and silver to the sulphide, state. The gold-bearing material contained 24.05 mg. of gold per ½ gram and the silver-bearing material 73.77 mg. silver per gram.

The pyrite (FeS_2) used was ground to 120 mesh and the sulphur determined as 47.4%, equivalent to 88.9% FeS_2.

The following experiments were carried on with varying mixtures of pyrite and silica, to which were added definite amounts of the gold and silver material. The mixtures contained, 6%, 13%, 20%, 40%, 60%, 80% and 88.9% of pure pyrite, or, 6.7%, 14.6%, 22.4%, 44.9%, 67.4%, 90% and 100% of the impure pyrite (88.9% pure), enough silica being added to the pyrite to make ½ assay ton.

While these tests were made primarily to determine the value of the nails charge, it was thought advisable to run niter fusions on the same series, particularly in view of the oft repeated statement, that charges requiring more than 20 grams of niter were not satisfactory. The nails charges were (tests A and B):

RESULTS OF TESTS BY THE NAIL, NAIL-ARGOL, AND NITER METHODS

Test No.	Pyrites (88.9% FeS_2) grams	Charge: Argol grams	Charge: Niter grams	Assay: Gold mg.	Assay: Silver mg.	Sulphur in iron pyrites grams	Weight of slag grams	Sulphur in Slag: Total %	Sulphur grams	Sulphide %	Sulphur grams	Oxidized[3] %	Sulphur grams	Sulphur %	Removed grams
No. 1															
A	0.96	.....	.....	24.14	73.78	0.455	43.7	1.1	0.48	0.095	0.043	1.01	0.43	.....	.....
B	0.96	5	.....	23.68	71.46	0.455	36.5	1.0	0.365	0.33	0.117	0.66	0.248	19.7	0.09
C	0.96	1	.....	24.08	74.10	0.455	.....	.....	.....	.....	.....	.....	.....	.....	.....
No. 2															
A	2.08	.....	.....	24.18	73.42	0.982	45.0	2.0	0.90	0.48	0.216	1.52	0.69	8.1	0.08
B	2.08	5	.....	23.65	72.09	0.982	.....	1.9	.....	0.84	.....	1.06	.....	.....	.....
(1)				(1)	(1)										
C	2.08	.....	.....	23.92	72.96	0.982	.....	.....	.....	.....	.....	.....	.....	.....	.....
No. 3															
A	3.2	.....	.....	23.97	72.92	1.52	48.2	2.6	1.25	0.97	0.467	1.63	0.79	17.7	0.27
B	3.2	5	.....	24.10	72.96	1.52	38.5	2.9	1.1	1.9	0.731	1.0	0.37	26.9	0.41
C	3.2	.....	2	24.12	74.88	1.52	.....	.....	.....	.....	.....	.....	.....	.....	.....
No. 4															
A	6.4	.....	.....	23.88	71.02	3.03	50.7	5.4	2.73	3.07	1.55	2.33	1.18	10.0	0.3
(2)				(2)	(2)										
B	6.4	5	.....	21.36	60.78	3.03	37.5	5.7	2.13	3.7	1.61	2.0	0.52	29.7	0.9
C	6.4	.....	9	24.14	73.82	3.03	.....	.....	.....	.....	.....	.....	.....	.....	.....
No. 5															
A	9.6	.....	.....	23.98	70.14	4.55	52.8	7.6	4.0	4.87	2.57	2.73	1.5	12.1	0.55
B	9.6	5	.....	23.92	66.10	4.55	42.5	7.5	3.28	5.3	2.25	2.2	1.03	27.9	1.27
C	9.6	.....	17	24.16	74.84	4.55	.....	.....	.....	.....	.....	.....	.....	.....	.....
No. 6															
A	12.8	.....	.....	23.83	67.45	6.02	57.5	8.8	5.06	6.01	3.45	2.79	1.61	16.5	0.96
B	12.8	5	.....	24.00	63.68	6.02	48.5	8.4	4.15	6.71	3.25	1.69	0.90	31.0	1.87
C	12.8	.....	24	24.18	74.18	6.02	.....	.....	.....	.....	.....	.....	.....	.....	.....
No. 7															
A	14.5	.....	.....	23.99	66.13	6.86	62.4	6.8	4.25	5.5	3.43	1.3	0.82	38.0	2.61
B	14.5	5	.....	24.12	62.56	6.86	46.0	8.8	4.0	7.6	3.49	1.2	0.55	40.5	2.80
C	14.5	.....	32	24.09	73.90	6.86	.....	.....	.....	.....	.....	.....	.....	.....	.....

Uncorrected results of gold material, 24.08 mg.
Uncorrected results of silver material, 73.77 mg.
Tests marked A Nail Assay.
Tests marked B Nails Assay + 5 grams argol.
Tests marked C Niter Assays.

Note 1. Bead No. 2C froze.
Note 2. In assay No. 4B a little lead was lost.
Note 3. Oxidized sulphur obtained by difference.
Tests No. 1, 2, 3, 4, 5, 6, 7, corresponded to 6, 13, 20, 40, 60, 80, 89.9% respectively of pure pyrites on ½ A.T.

Pyrite mixture	0.5 a.t.
Sodium carbonate	30 grams
Litharge	25 grams
Borax glass	10 grams
Nails, 10-penny	4 grams

Test A contained no argol, while test B contained five grams in each assay. For the niter tests (tests C), the following charge was used:

Pyrite mixture	0.5 a.t.
Sodium carbonate	15 grams
Litharge	105 grams
Silica	5 grams
Borax glass	7 grams

Niter or argol to give the required amount of lead.

The silica and so large an amount of flux are not required in the lower pyrite mixtures, but were used to make the flux charge uniform. The number of grams of pyrite in ½ assay ton of mixture is indicated in the large accompanying table.

The fusion of the nail charges which contained no argol were of the usual character, those containing small amounts of pyrite were fairly satisfactory, but as the percentage of pyrite increased there was less complete dis-

Note—Abstract by the authors from their article, "Bull.," A. I. M. E., June, 1913.

[1]Assistant professor, department of metallurgy, Columbia University.
[2]Lecturer in mining and metallurgy, School of Mining, Kingston, Ontario.

solution of constituents; the nails were badly corroded, and in some cases, to such an extent that they sank beneath the slag. The lead did not collect perfectly in all cases, leaving small particles in the crucible on pouring.

Argol Improved Results

The charges containing argol were much better, but showed the same general effect with the increased amount of pyrite. Complete dissolution seemed to take place and in no case were the nails corroded to such an extent that they disappeared. The charges poured much better, showing a good collection of the lead. This improved condition is unquestionably due to the decrease in oxidation of constituents in the charge. As this charge is highly basic, containing large amounts of sodium carbonate, the sulphides are readily soluble, but, if the iron present is converted to oxide, this will not be readily taken into solution. It is not permissible to make this slag highly acid to take these oxides into solution, as the sulphides would then fail to dissolve.

It was noticed in the different fusions that the character of furnace atmosphere, whether oxidizing or reducing, had considerable effect on the charge. If the atmosphere was strongly oxidizing the fusion was not nearly so good as when it was reducing. This was apparently due to the same causes as where argol is present in one case and absent in the other.

The large increased weight of slag in charges high in pyrite is due partly to the greater amount of iron dissolved, and partly to the material corroded from the crucible on account of the much more basic character of these slags.

It was considered probable that the amount of sulphur in the slag and its state of oxidation had a decided effect on the results. Therefore, the slags were analyzed for sulphur compounds. The results are included in the accompanying table.

Sulphur as Sulphide Causes Silver Loss

From the results, it will be noted that the silver losses increase with the sulphur content. Also, that in charges containing argol, the loss is somewhat greater than where argol is omitted. The principal difference in the slags of these two methods is in the percentage of sulphide sulphur present, particularly in the early stages of fusion when oxidation is prevented in the charge containing argol. This indicates that the silver losses are due to sulphide sulphur.

This explanation seems quite reasonable as the slags are somewhat of the nature of a matte, particularly where sulphide sulphur is high, and it is well known that mattes are good solvents for silver. For the same reasons, it was expected that the gold loss would also increase to a condesirable extent. It will be noted from the table that the increased loss is not proportionate to the silver loss, nor does it seem to increase progressively with the sulphur.

It may be interesting to note that the iron dissolved from the nails is considerably in excess of that required to form iron sulphide (FeS), and that the scale or coating on nails after fusion was iron oxide and not iron sulphide. It was demonstrated that metallic iron will reduce sodium sulphate formed by oxidation, in these charges, with the production of sulphide, itself being oxidized. The sulphide is subject to atmosphere reoxidation and again reacts with the iron, giving a continuous cycle at the expense of the nails. It is the production of this large amount of iron oxide in a high-soda, low-acid charge which accounts for the unsatisfactory fusion and poor slag in this assay.

Results of Nails and Niter Methods

The nails method gives low results for silver with ores containing above certain amounts of sulphide sulphur, this loss increasing with the percentage of sulphur in the ore, reaching a maximum of about 10 per cent. in the straight nails charge under the conditions of this test. In the case where argol was used, giving increased sulphide sulphur in the slag, the maximum loss was about 15%. The gold results are irregular and somewhat lower, possibly 1%. The loss does not appear to be affected by the addition of argol to the charge. Silver determinations in high sulphide ores should not be made by the method, except for approximate results. When the sulphur in the ore is not much greater than will be oxidized by the PbO, a fair approximation may be obtained. The method will give fairly good results on medium- and low-grade gold ores, say one ounce, as the loss is less than the accuracy of ordinary work. The niter method gives good results, even with as much as 30 grams of niter present in the charge, and a 30-gram button is necessary in assays containing a large amount of niter.

A portion of the iron nails which project into the lead is converted to sulphide, but the greater amount of iron, that in contact with the slag, is removed as iron oxide. The scale on the iron nails is not iron sulphide, but a mixture of ferric oxide, magnetite and slag. To obtain a good slag by the nails method with slight corrosion of nails, it is necessary to protect fusion from oxidation. This, however, will lower silver results.

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Natural Gas in Austria and Hungary

The natural-gas occurrences lately discovered at Wels, in Upper Austria, have been the subject of very careful examination by Mr. Werndl, who publishes the results in the *Berg- und Hüttenmännische Rundschau.* As regards chemical composition the gas is almost identical with that of Neuengamme, near Hamburg, the methane contents being in both cases 91.5%. Though the discovery of the gas is of comparatively recent date, several manufacturing concerns in the neighborhood of Wels are already supplied with power by the existing wells. Its calorific value is high, the cubic meter being equal to 8321 cal., which means that the gas would be suitable for metallurgical purposes. The Austrian government is actively engaged in further exploring the ground.

The boreholes pierced in Hungary in search of potash have proved barren of that substance, but have, as is known, resulted in the discovery of large volumes of pure natural gas, says the *Mining Journal,* Sept. 13, 1913. M. Herbing, in *Zeitschrift für Angewandte Chemie,* imparts the ensuing particulars. The first borehole was sunk at Kissarmus, in Transylvania, and continues to discharge gas with the same energy as during the past two years, which appears to confirm the opinion of the existence of an extensive area of productive strata. Geological investigations have shown that the presence of gas is associated with an anticlinal 50 miles long, and that the strata, so far from being undisturbed, as was supposed, are considerably folded. Escapes of natural gas from

streams and ponds are frequent, and the occurrence at Kissarmus may not be singular, since tectonic considerations render it probable that rocks throughout the province are permeated by the gas. From the commencement the first bore yielded about 800,000 cu.m. of gas with 99% of CH_4, but after a gas explosion in a neighboring work it increased to a million in 24 hr. From five other boreholes, whose depths varied from 220 to 720 ft., were obtained from 36,000 to 210,000 cu.m., or a total of 431,000 in 24 hr., which, with other wells, reached 440,000 per diem. As the abundance of gas is in relation to depth, the yield can be enhanced by deepening the bores should they show symptoms of abatement. The output of the principal borehole could be conveyed by piping—280 miles—to Buda-Pest for an estimated outlay of £846,000. This city burns 300,000 cu.m. of gas daily, and the cities situated along the route would easily absorb the surplus. Observing what is taking place with natural gas in America, there is no doubt that Hungary will profit by the use of this fuel during a long future.

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Patience and Cheap Labor in Mexican Mining

By William H. Yeandle*

Many of our friends would have us believe that Mexico still presents a fertile field to the sober and industrious prospector. Their error lies in their failure to realize that several million patient, if not sober and industrious, prospectors have been investigating Mexico for nearly 400 years. Should you stumble unassisted across an outcropping showing surface values, you will usually find, on inquiry, that Timotéo's great-grandfather drove the narrow little tunnel on the hanging-wall streak, which you overlooked, or that Juan Sánchez brought in sorted ore from the same outcropping week before last.

Perhaps the most common problem which confronts the examining engineer in Mexico, is as to whether the old mine can be made profitable by extensive development and the application of modern methods. Alas, too often the old opencuts are taken as *prima facie* evidence in the affirmative, with entire omission of the factors of time and personality from the great mining equation. I believe that it is almost safe to say that 50% of the mining failures in Mexico are due to these omissions, and not as we are often told, due to lack of capital or poor management. The remaining 50% being due (in case the question be raised) to an absence of ore.

I wonder if there is a mine, near-mine or prospect hole in Mexico, concerning which a report has not at some time been written, setting forth under special caption in italics certain data concerning the cheapness of the labor. This report, however, usually omits the data concerning the amount of work accomplished each day, so that you are not in a position even to guess whether that amount will net you at the end of the year 100 ft. of drift or 1000 ft. If, to your sorrow, you find that the amount is approximately 100 ft., what are your feelings on the subject? Why you immediately try to increase the efficiency of your men. First, you raise wages a little—no results; a little more—and no results; then a compressor and drills—but now you have modernized and you are either ready to compare costs with the best of them or your mine is closed down and you are out of a job. In either case your 50-centavo peon and your 75-centavo miner are things of the long ago. You will never find modern methods and cheap labor in the same canoe; if you do, you will probably find them under the thwarts with a strangle hold on each other's necks. Not that Mexican labor is absolutely inefficient, but to the man in a hurry, it is not cheap.

I do not feel called upon to add anything to the long catalog of what modern men, methods and machinery have accomplished in Mexico; it is a truly remarkable story set forth in annual reports, cost sheets and dividends, and if this account is not sufficiently replete with fine writing to suit your individual fancy, our friend the promoter, who is trying to dispose of the *antigua*, will inform you of the 1500-lb. stamps, the 40-ft. stopes of 450-gram ore from which the old operators extracted 3 ft. of high-grade, and the 50 to 60 tons of fine bullion which the Pachuca camp is shipping monthly. I do feel, however, that we give too little credit to the old Mexican miner, with his cheap labor and his abundant store of patience, and I would like to add one to the story that each engineer of Mexican experience has already gathered along these lines.

The Development of the Santa Gertrudis

It is well known that the orebodies of the Pachuca district, which have attained present-day fame, did not come to the surface; also, that the Santa Gertrudis is a much advertised and truly great mine. To whom do we owe it? The vein lies entirely off the belt which covered the original area of production. The outcroppings came to the surface over only a short distance and though well marked, were entirely barren. In 1879, a small group of Pachuca miners began sinking the old San Juan shaft. Funds were scarce and capital hard to interest in an unproved section of the camp, but rich strikes in other portions of Mexico, especially in Sierra Mojada, and an unfailing faith in their own judgment kept things slowly moving. Shares were issued on which assessments of 10, 15 or 25 centavos per week were accepted. The employees of the active mines in the camp subscribed and a small boy on a burro was sent from mine to mine on each payday to collect the assessments. Even the watchman and the *malacatero* on the Santa Gertrudis itself paid in weekly a small portion of their wages. At the end of 1885, the shaft had reached a depth of about 200 m. and a crosscut had encountered a narrow streak of ore in the vein. This oreshoot was only 75 ft. long and pinched out entirely in depth, but it kept things going until a drift east finally found the apex of the San Guillermo orebody, which has been going down ever since until today at a depth of 500 m. its lateral extension has been proved from the Santa Gertrudis, through the Barron and into the La Blanca mines; a truly wonderful body of silver ore. This, however, is the story of a bonanza.

Iron and Gold at Comanja de Corona

About 25 miles east of the city of Leon, Guanajuato, in a fertile valley, lies the old mining camp of Comanja de Corona. It is said that the principal mine of the district was worked before the discovery of the mines of the Guanajuato district. The valley is studded with the

*United States Smelting, Refining & Mining Co., 411 Edificio de la Mutua, Mexico, D. F., Mexico.

ruins of dwellings, arrastres, etc., attesting the importance of the camp in some previous epoch. One of the most interesting ruins is that of an old iron-furnace plant which includes within its adobe walls some two or three acres. The ore for this plant was obtained by most careful selection from a small deposit of ore lying on the contact between some shales and an underlying granite dome which has been exposed by erosion. The fuel used was charcoal, while the limestone was packed a distance of about 5 km. from a thin bed which overlies the shales at an elevation of about 1000 ft. above the plant.

The product from the plant was converted on the ground into rude agricultural implements, which found a ready sale in the neighboring valleys. The business is said to have been profitable, so much so that it was sold at a comfortable figure to one of the pioneer Englishmen of Mexico, who purchased with the idea of a consolidation of several similar industries which had been established in the central portion of Mexico. With the construction of the Mexican Central Ry., the profits automatically ceased and the plant was abandoned.

The granite dome mentioned is traversed through its greatest length by a series of north and south veins dipping at an angle of 38° to the west. In the granite the veins are constant and the mineral content remarkably uniform. In width the veins average about 2 ft. Fracturing was due to intrusions of andesite and the veins extend through from the granite into the shales, where they lose, however, their continuity and the ore deposition assumes the form of small and irregular lenses of somewhat higher value. These lenses have received but little attention, due to the encountering, in the only attempt at exploitation, of large quantities of extremely acid water, the acidity being caused by pyrite in the shales.

The principal mine of the district, Los Remedios, was located on the veins in the granite dome. The original workings started from the summit of the dome and evidently reached a considerable depth before the Remednios crosscut tunnel was driven from near the base of the dome. This tunnel leads east for a distance of 2300 ft. and cuts the Remedios vein at a depth of 750 ft. on its dip. The tunnel also cuts three other veins, all carrying values, but on account of the presence of variable quantities of chalcopyrite and blende they have not been so extensively worked as the Remedios, which shows the base metals only below the tunnel level. The lateral extension of the workings on the Remedios vein is 850 ft. The entire mass of the vein was extracted from this block of 850x750 ft., the ore after sorting underground being packed a distance of 6 km. to a small stream where it was treated in arrastres. The discard from the sorting was left underground where it has mixed with wall rock, broken in mining a hanging-wall streak of the vein, which was probably of higher grade than the vein itself. It is estimated that there are some 70,000 tons of these fills in the workings on the four veins, of which amount 75% is barren granite, thus indicating that the percentage of payable ore in the vein was high. The average value of the fills, after sorting to remove only the white granite, is 2 grams of gold and 200 grams of silver. The average value of the vein in place, including small pillars in the stopes, is 4 grams of gold and 300 grams of silver. Even taking into consideration the fact that most of the samples from solid ground represent the outskirts of the orebody, it is doubtful if the average value of the entire block exceeded 6 grams of gold and 400 grams of silver and probably did not quite reach this figure. The period of activity on this mine probably extended over the insignificant interval of 100 years.

It is axiomatic that the old Mexican miner worked nothing from which he did not derive a profit and the evidence in this case points to the fact that not only the Remedios mine but the entire district paid dividends, even if they were probably separated by rather extensive intervals.

It is a case, I believe, of, "Hats off to the *antiguo*"; for I rather question the advisability of attempting to mine this grade of ore from a 2-ft. vein even under modern conditions. This opinion is strengthened by two interesting modern ruins, i.e., a stamp mill on the surface and a wire-rope tram in one of the richest of the old, filled stopes. This tram is complete with its sheaves and terminals, the buckets having a capacity of 25 lb. each, the track rope being of ½-in. diameter and the traction cable of galvanized bell cord.

In case anyone thinks that I am in error on this subject, I would say that there are five other known veins in the mountain and that the labor is almost as cheap today as it was 50 years ago; also that excess baggage on his patience should be quite an item in his expense account.

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Oil Field in the Ocean

By L. M. Ediholm*

Unique among the oil fields of the world is the Summerland group of wells in California, which extend out into the Pacific Ocean. There are 141 producing wells in this group which is situated about 18 miles from Santa Barbara. These wells are drilled out in the ocean just off the coast and 100,000 barrels are taken from the oil sands underlying the ocean bed every year. This interesting spectacle of derricks built out into the sea is visible from the train on the way from Los Angeles to San Francisco.

A Submarine Oil Field

*4624 Figueroa St., Los Angeles, Calif.

Ontario Mineral Production

Returns made to the Bureau of Mines under the Mining Act show that the production of metals and metalliferous substances from the mines and works of Ontario during the nine months ended Sept. 30, 1913, was as follows. The changes as compared with the corresponding period of 1912 are also noted.

Product	Quantity	Value	Inc. or Dec.	
Gold, oz.	159,962	$3,281,027	I	$2,163,692
Silver, oz.	23,171,536	12,967,138	I	259,312
Copper, tons	9,237	1,311,681	I	169,605
Nickel, tons	18,233	3,825,633	I	457,196
Iron ore, tons	143,979	314,590	I	213,306
Pig iron, tons	440,954	5,792,022	D	259,956
Cobalt ore, tons	71	12,917	D	44,697
Cobalt and nickel oxides, lb.	740,089	290,597	I	113,811
Lead ore, tons	882	3,000	I	3,000

Gold production is chiefly from Porcupine, where the Hollinger and Dome are the leading mines. The latter is adding 40 stamps which will double its milling capacity. Porcupine Crown and McIntyre Porcupine also contributed considerable bullion. The total yield from the Porcupine mines was $3,106,250, leaving $174,777 as the product of outside areas. These were Long Lake (Canadian Exploration Co.), Swastika (Swastika Mining Co.), Kirkland Lake (Tough-Oakes), Larder Lake (Goldfields Ltd.) and Sturgeon Lake (Northern Gold Reef).

Silver production was slightly greater, both in ounces and value, than for the same period last year. The number of producing mines was 31, of which 27 are in Cobalt proper, one in Casey township, two in Gowganda and one in South Lorrain. Nipissing led with a total output of 4,387,765 oz., followed by Coniagas with 2,662,678, La Rose with 1,903,345 and Cobalt Townsite with 1,826,422 oz. Kerr Lake, McKinley-Darragh, Buffalo and Crown Reserve were also well up. Of the product 10,512,396 oz. were in the shipments of ore, 6,184,271 in concentrates, and 6,444,099 in bullion. By camps, Cobalt proper 21,956,561 oz., Casey 607,212, Gowanda 342,380 and South Lorrain 234,613 oz. From auriferous ores 30,770 oz.were obtained.

Nickel and copper production was in excess of that of any previous nine months. There were raised 535,265 tons of ore and smelted 569,898 tons. The bessemer-matte product was 34,343 tons, the estimated contents of which were 18,233 tons nickel and 9237 tons copper. The Canadian Copper Co. remains the principal producer, but the new and well equipped smelter of the Mond Nickel Co. at Coniston, which is now in operation, will doubtless increase that company's output.

There were five iron-ore mines in operation, the Helen and Magpie, Moose Mountain, Bessemer and Belmont. The Canada Iron Corporation concentration plant at Trenton is now at work on ore from the Bessemer and Childs mines. At the Magpie mine the roasting plant is treating siderite, from which it expels the carbonic-acid gas and sulphur, thus producing a first-rate material for the blast furnace. If the process proves commercially successful, it will turn to account a large quantity of sideritic material, hitherto but little regarded as a possible source of iron.

Four blast-furnace companies produced 11,967 tons less pig iron than was made during the corresponding term of 1912, and the average value per ton declined from $13.36 to $13.16. At Port Colborne the new furnace of the Canadian Furnace Co., a subsidiary concern of the Buffalo Union Furnace Co., was blown in on Sept. 27. The plant has a capacity of 300 to 325 tons of pig iron per day.

The output of cobalt and nickel oxides, being refined byproducts of the Cobalt silver ores, is steadily increasing, and had a value $176,786 greater than in the first nine months of last year. A bounty is paid by the Ontario Government of 6c. per lb. on the metallic contents of refined cobalt oxide and nickel oxide.

⁂

Utah Copper Co.

Report of the Utah Copper Co. for the third quarter of 1913 shows that 32,287,452 lb. of copper were produced: 9,849,043 lb. in July; 10,640,981 lb. in August and 11,817,428 lb. in September. Production for the first and second quarters was 7,961,489 lb. and 10,595,149 lb. respectively.

Both plants treated a total of 2,035,391 tons of ore, the Magna plant handling about 56% of the total and the Arthur plant 44%. The average grade of the ore was 1.2459% copper.

Average cost per pound of net copper was 9.068c. after allowing for smelter deductions but without crediting miscellaneous income. If the latter were credited, the cost would be reduced to 8.187c. per lb. of copper. Low grade of ore treated was responsible for the comparatively high cost of production.

Net profit from milling operations was $1,819,354; other income in Utah, $11,857, and income from Nevada Con. Copper Co. dividends, $375,188, a total of $2,206,399. Dividends of $1,186,695 were paid, leaving a net surplus for the quarter of $1,019,704. Earnings are based on copper at 15c. per lb. Total copper on hand and in transit, sold and unsold, was 32,053,789 lb. Unsold copper is inventoried at slightly less than 12½c. per lb. Both plants were in continuous operation and exceeded all previous records as to tonnage, averaging a little more than 22,000 tons per day.

The Bingham & Garfield Ry. handled its largest tonnage of ore and commercial freight, an average of 16,018 tons of ore and 2336 tons of other freight having been transported daily.

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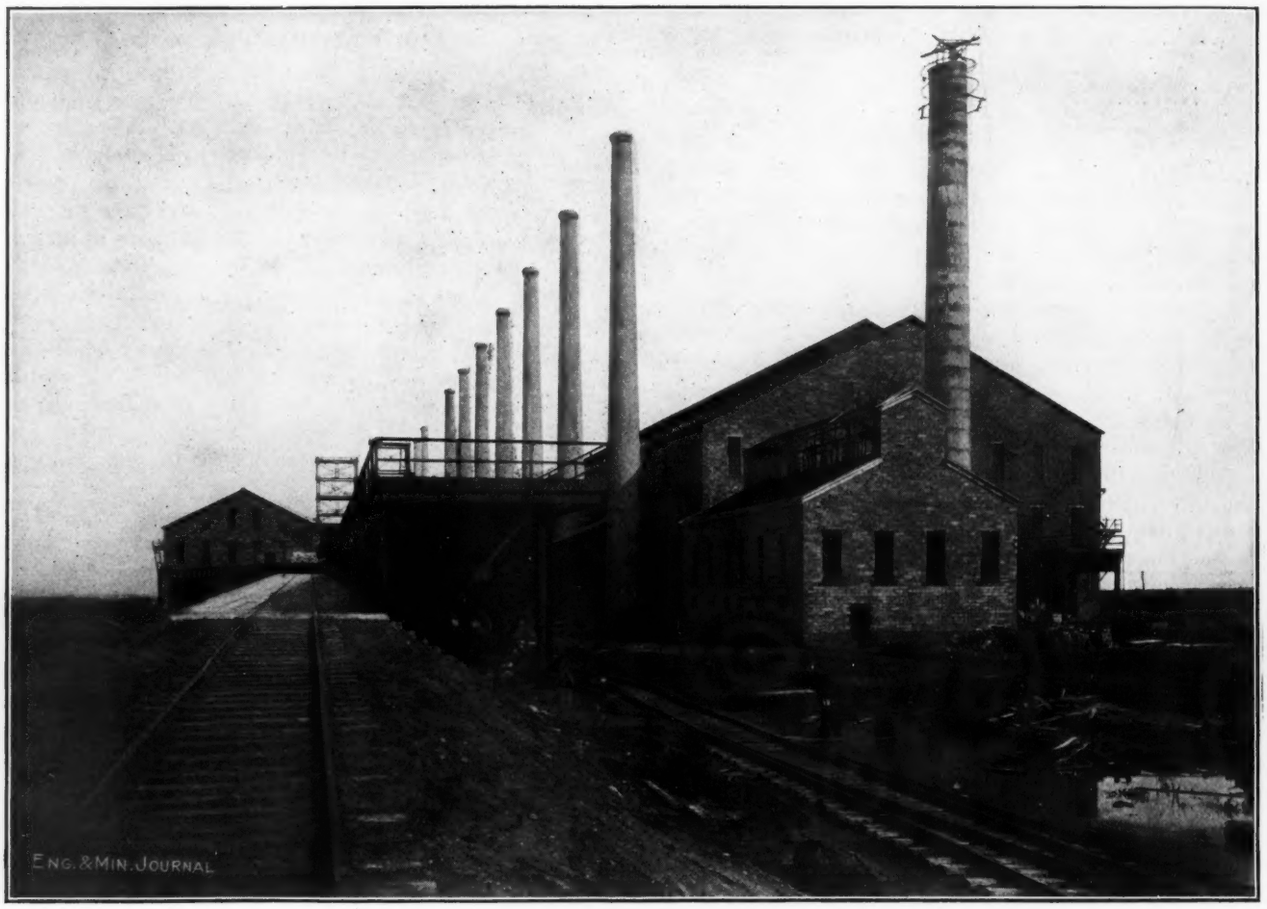
Withdrawal of "Copper" Lands

Within the last year a public-land withdrawal of an unusual type, designated "mineral-land withdrawal No. 1, Arizona No. 1," was made at the instance of the U. S. Geological Survey. The withdrawal covers an area in the Warren mining district (Bisbee, Ariz.), in which investigations by the survey revealed geologic conditions favorable to the occurrence of deep-seated deposits of copper, on which no surface discovery, as required by the lode law, can be made. As discovery and hence valid location of such deposits must depend on expensive deep drilling or deep shafting and will require time, there was danger that before prospecting of this kind could be completed attempts would be made to obtain title to the lands by means of state selections or other nonmineral entries. Accordingly the President directed that an area including approximately 9787 acres be withdrawn. The lands in the withdrawn area are open to exploration and purchase under the mining laws, so far as they apply to metalliferous minerals, but are not subject to other forms of entry. Later 1280 acres of this reserve were restored to entry.

PHOTOGRAPHS FROM THE FIELD



OPENHEARTH BUILDING AT MINNESOTA STEEL CO.'S NEW PLANT

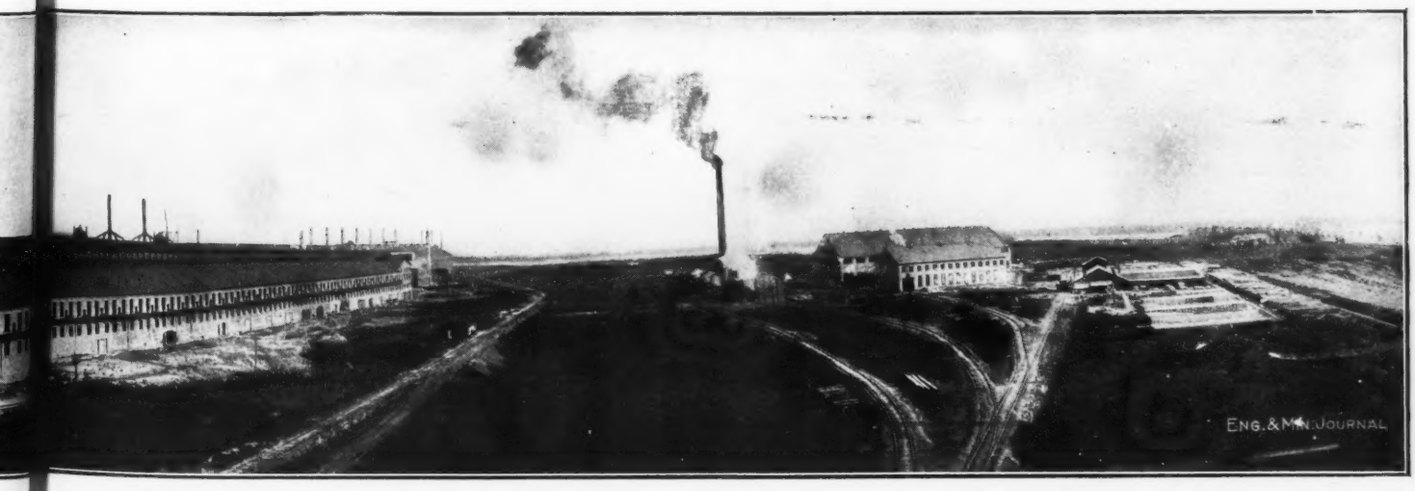
Company is a subsidiary of the United States Steel Corporation.

PANORAMA OF THE MINNESOTA STEEL CO.'S NEW BLAST FURNACE

Plant has been under construction for nearly four years and it will be another 18 months before it is ready for operation. covers an area of 1500 acres with two miles of water front on the lake, a widened basin of the St. erected, built entirely of concrete even to floors and with steel

STOVES AND FURNACES AT MINNESOTA STEEL CO.'S NEW WORKS
Each of the two blast furnaces will have capacity for smelting 500 tons of ore per day.

GAS ENGINES AT MINNESOTA STEEL WORKS WILL DRIVE COMPRESSORS AND GENERATORS
Besides the blast furnaces, 90 coke ovens will supply gas.



AND STEEL PLANT AT HEAD OF LAKE SUPERIOR, NEAR DULUTH

It is to be a much more extensive works than was originally planned. Plant is on Spirit Lake, nine miles from Duluth, Louis River. The "model" town is shown at left of view, where 157 houses (57 are completed) will be doors and window frames. Plant has cost $7,000,000 to date.

Chronology of Mining for November, 1913

Nov. 2—Fire in Rio Tinto mine, Spain, killed seven men.

Nov. 12—Mond Nickel Co. purchased a part of the Levack group of nickel properties in the Sudbury district, Ontario.

Nov. 13—Electric light and power rates hearing at Butte, Mont.

Nov. 14—Judge Bourquin, in Minerals Separation case against Butte & Superior, rendered decision in favor of plaintiffs—Smoke lawsuit instituted by Montana farmers for relief from fumes from Anaconda company's reduction works, dismissed.

Nov. 15—Salt Lake & Alta R.R. from Midvale to Wasatch, completed.

Nov. 17—Rio Tinto strikers resume work—Explosion of dynamite in Kennedy mine, Jackson, Calif., killed three men and injured one.

Nov. 18—Explosion in mine of Alabama Fuel & Iron Co. killed 40 men.

Nov. 19—General strike order issued to French miners by the national federation, with the object of obtaining an eight-hour workday, failed as only a few of the 200,000 miners in France walked out.

Nov. 22—Reduction of 10% in wages in Joplin, Mo., district.

Nov. 24—Riot of natives, at the Premier diamond mine in South Africa, in which three were killed and 22 wounded.

Nov. 27—S. Pearson & Sons abandoned attempts to secure oil concessions in Colombia.

Nov. 31—Government removes restrictions so that Indian laborers may enter British Columbia.

Rand Mining Notes

JOHANNESBURG CORRESPONDENCE

The effect of the strike on the labor supply of the mines is shown by the returns from the W. N. L. A. There were 222,057 natives in the employ of the mines in May, 1913, and in August, the number had fallen to 180,631, showing a decrease of 42,420. The normal decrease for this season when natives return to their homes to plow, is 20,000, so that the strike caused a loss of about 22,000 natives; 1100 whites were dismissed. The output of the mines was fairly well maintained by stopping development work and drawing on the large reserves. A commission has been appointed to investigate any grievance the native laborers may have, and Colonel Gorgas is expected to arrive in November to report on general health conditions. The Rand Water Board is preparing a scheme to place a dam on the Vaal River and to spend £1,250,000 in increasing the water-supply by 10,000,000 gal. per day.

At the Meyer & Charlton mine all blasting is now being done from the surface when all men are out of the mine. The ratio of white to colored workmen last year was 1 to 8.1, showing a fall compared with 1912 (1 to 7.7). The efficiency increased somewhat. The tons raised per annum per white employee rising from 1030.9 to 1106; per native from 132.5 to 136.3 and per person from 117.4 to 121.3. The collieries showed only 50 tons per person. In the Transvaal, 471,850 tons of coal were raised.

The reef was struck in No. 3 shaft of the State mines at a depth of 3650 ft., assaying 3.8 dwt. on 30 in. New development work is confined almost entirely to the East Rand and the "State mines." Modder Reefs, Van Ryn Reefs, Geduld mines and Springs mines continue to develop well. Labor matters are quiet and there seems no fear of any future outbreaks.

Ray Consolidated Copper Co.

The report of the Ray Consolidated Copper Co. for the third quarter of 1913 shows a production of 12,969,120 lb. of copper, divided into 4,097,004 lb. in July, 4,401,565 lb. in August and 4,470,551 lb. in September. In addition to the copper from concentrates, 84,440 lb. were produced from ores shipped to the smeltery, making a total production of 13,053,560 pounds.

Total ore milled was 575,190 tons, averaging 1.72% copper, a daily average of 6252 tons of ore milled. Average mill recovery was somewhat lower than for the previous quarter, due to shortage of water.

Increase of costs was due to improvements which were included in operating expenses. Average mining and coarse crushing was 76.43c. per ton. Of this amount about 4c. is chargeable to coarse crushing.

Underground development amounted to 19,160 ft. No. 1 shaft hoisted 67% of the output, No. 2 shaft 29% and No. 3 shaft, 4%.

Average cost of copper was 10.155c. per lb., after smelter deductions and applying earnings of the Ray & Gila Valley R.R. as a credit to costs.

Operating profits were $651,660, and miscellaneous income, $9425, a total of $661,085. Earnings are based on copper at 15c. per lb. Copper on hand and in transit, sold and unsold, amounted to 14,660,228 lb. Unsold copper is inventoried at 13.15c. per pound.

Second quarterly dividend was paid Sept. 30, 1913, amounting to $543,903, making total disbursements to date this year $1,087,559.

The Bureau of Mines

WASHINGTON CORRESPONDENCE

President Wilson is expected to take strong ground during the current session of Congress in favor of an enlargement of the powers of the Bureau of Mines. The statements made in his message are taken as good evidence of this disposition. The enlargement of powers is expected to be a grant of greater authority toward the enforcement of regulations designed to protect workers and also in applying the principles of what is ordinarily known as "conservation." That the Bureau will also be given an active share in the conduct of mining matters in Alaska, if the new bill designed to provide for a Government-constructed railroad line in Alaska should pass, is also predicted and there seems to be no question that distinct steps in that direction will be taken. Official legislation representing the views of the Administration has been prepared and will be introduced from time to time as occasion permits. It is believed that a new era of influence from the Bureau of Mines is about to open in consequence of the attitude of the administration in the particulars already referred to.

CORRESPONDENCE AND DISCUSSION

Revision of the Mining Law

I have addressed a letter, of which the following is a part, urging the President to use his influence to cause the General Land Office to issue clear directions as to the necessary requirements in doing the location work after discovery of a vein:

The pamphlet, now issued by the General Land Office, does not give this information, and I know from correspondence with the general and local land offices in several Western states, that information is refused on the ground that the matter may come before them and we are advised to see a lawyer. Many good mining claims have been lost to the honest and painstaking prospector through different opinions of lawyers as to what constitutes valid discovery work. I suggest a general law to cover all the states and territories, viz.: After notice of discovery of a vein or lode that 240 cu.ft. of earth be removed along the strike thereof, 4 ft. deep, 6 ft. wide and 10 ft. long; or, 6 ft. deep, 4 ft. wide and 10 ft. long; or a shaft 10 ft. deep, 6x4 ft. wide, whichever may be preferable to the prospector.

My 33 years' experience as a prospector and mining man in many camps throughout the West, warrants me in saying that such a law or ruling by the Secretary of the Interior would be most satisfactory to all honest prospectors.

THEODORE A. WOODRUFF.

Parker, Ariz., Nov. 20, 1913.

Speculator Shaft Accident

Mr. Emmons, in the JOURNAL of Nov. 8, takes exception to a "By the Way" item about the death of a miner from a falling rock in the Speculator shaft at Butte. The argument seems to be a fallacy, which may be expressed "Do not clean your shaft sets, because in that case a falling rock may lodge." What harm in that? Why, it might fall off and hurt somebody. In the first falling, then, it would not hurt anybody, only a secondary fall is dangerous. Now, it seems to me that a falling rock is a falling rock, and if it falls from the skip dump, it is somewhat more dangerous than if it falls from a set part way down.

When all the sets once become covered with fine dirt at the angle of repose, all material falling thereafter must fall to the bottom. If the sets be periodically cleaned, then practically no material will ever fall to the bottom. Which is safer? The covering of fine dirt on the sets protects the timber, but are we protecting timber or men?

Examination of many shafts will show the upper sets full of débris and the lower sets comparatively clean. Mr. Emmons considers these lower sets a menace. Then why wait for the slow accumulation of material accidentally spilled? Why not at once cap every plate with a slanting board, which would direct all falling rocks to the very bottom and attain the acme of safety?

The letter is along the line of the old and still frequently heard arguments, such as, that safety dogs should not be used on cages because they seldom work; that automatic stops on hoists are dangerous because they take away the sense of responsibility of the engineer, etc., without number. The inspiring motive to such talk is, of course, the disinclination to expend the time, thought, care and money that real safety measures require. Here on the Mesabi the opposite attitude prevails; extraordinary precautions are taken to conserve the lives of the miners and "Safety First" is emphatically safety first and not a poor second.

It does not seem to me that there was any intent in the original article to criticize any individuals for the accident. The practice is too common to justify individual criticism. Letting dirt accumulate on the shaft sets is country-wide if not world-wide. But it is not right, nevertheless.

Chisholm, Minn., Nov. 10, 1913. A. MINOR.

Slater Lixiviation Process

Under the above caption, the JOURNAL of Sept. 27, 1913, contained a review of the specifications of pat. No. 1,066,855, covering a process of lixiviation of copper-bearing ores. Barring the small mistake as to the silver being converted into "sulphide," which should have been "chloride," it was a fair review. In the last paragraph, however, it is suggested that the process might "serve as a hint to more practical development." The editor was not aware, when he wrote that review, that further and more practical developments had already been made, having especially in view the recovery of the copper from the solution. This further development was reserved for another application for patent.

The method adopted for the recovery of the copper from the solution is by precipitation as cupric hydroxide, and this is accomplished by the use of the sodium hydroxide, which is produced in the cathode compartment of the electrolyzer in the decomposition of the sodium chloride. A further improvement lies in the recovery of the iron of the lixiviant as ferric hydroxide and its use again as a catalyzer in the production of hypochlorous acid in the anode compartment of the electrolyzer. A still further improvement is the use of a part of the cupric hydroxide, obtained from the ore, as cathodes in the electrolyzer, where it does duty as a depolarizer and at the same time is reduced to metallic copper.

I may or may not use ferrous chloride in forming the original solution preparatory to electrolysis. And I may or may not add sodium hydroxide to the anolyte during electrolysis. These details of manipulation will depend upon the nature of the ore and whether or not it is preferable to have some alkaline hypochlorates present or only hypochlorous acid.

If both compartments of the electrolyzer be charged with a solution of sodium chloride, and if, during electrolysis, ferric hydroxide be added to the anolyte, to fur-

nish oxygen to the chlorine, hypochlorous acid will be formed in the anolyte and it will be found that a large amount of this powerful oxidizing agent can be accumulated and held in solution, ready to give up both oxygen and chlorine as soon as brought into intimate contact with the ore.

As to the separation of the iron and copper from the solution, it will be found that if a hot solution of sodium hydroxide be added to the mixed solutions of iron and copper, and the sodium hydroxide is added in equivalent proportion to the iron content of the solution, and the whole be agitated, the iron alone will be separated and will be precipitated as ferric hydroxide. The copper will be left in solution, and, when the ferric hydroxide has been filtered off, a further addition of a hot solution of sodium hydroxide, in excess, will precipitate the copper as cupric hydroxide. It will be found that the copper is precipitated as a dense black mass having the composition $3\,CuO,\ H_2O$; three molecules of cupric oxide to one of water. The sodium chloride is, in this way, regenerated for use again in another cycle of operations.

The reactions in the decomposition of a solution of sodium chloride are too well known to require explanation here, but the reactions in the anode compartment of the electrolyzer, when ferric hydroxide is added thereto, may not be so well understood. The ferric hydroxide, being in suspension in the solution of sodium chloride, is attacked by the chlorine, being liberated at the anode with the resultant formation of ferric oxychloride and hypochlorous acid as follows:

$$2\,Fe(OH)_3 + 4\,Cl = Fe_2O_2Cl_2 + 2\,HClO + 2\,H_2O$$

Ferric oxychloride and chlorine will react to form ferric chloride and chlorine monoxide as follows:

$$Fe_2O_2Cl_2 + 8\,Cl = Fe_2Cl_6 + 2\,Cl_2O$$

The chlorine monoxide, with water, will form more hypochlorous acid as:

$$2\,Cl_2O + 2\,H_2O = 4\,HClO$$

It thus appears that we may have six units of hypochlorous acid formed in the anolyte through the intervention of two units of ferric hydroxide.

The lixiviant thus formed seems to have a peculiar selective action on the copper in such ores as those from Cananea and others of like character. Roasting or calcining is not necessary as the oxidizing action of the solution is such as to liberate a part of the sulphur in a free state. Some sulphuric acid is formed and also sulphate of copper, but the presence of sodium chloride results in a change therefrom to cupric chloride and sodium sulphate. The latter reacting with whatever lime is present renders it insoluble as calcium sulphate. Some alumina will go into solution as chloride. Arsenic will be left with the tailing as insoluble chloride and antimony, if present, will also be left in the tailing as an insoluble basic antimonious oxychloride. But very little of these will be acted upon unless there be a large excess of chlorine available over that required for the copper. The ferric chloride will be reduced to ferrous chloride, but will be precipitated from the solution as ferric hydroxide. Chalcocite goes into solution very readily; chalcopyrite more slowly. Pyrite is but very slightly attacked, if at all.

This process is a development from work done along similar lines, in Leadville, Colo., in the '80s. The work was then directed to the extraction of zinc. The present process is quite as applicable to zinc ores as to those of copper. It was devised, however, with special reference to the porphyries. It is also well adapted to that class of ores, chiefly silicates, which, while amenable to cyanidation for the gold and silver values, contain copper in such amount as to mullify the economic efficiency of the cyanidle process. The removal of the copper by this process leaves the ore in very suitable conditions for cyanidation, especially after a wash with a solution of the sodium hydroxide produced in the cathode compartment of the electrolyzer.

As to cost of treatment, it can readily be seen that the principal cost will be that of the production of the chlorine. The handling of the ore will be practically the same as in the cyanide process. The cost of generating the chlorine will depend upon the cost of electric energy at the place of operation. Here in California we can figure liberally at one cent per kilowatt-hour. One and one-third kw.-hr. will suffice for the generation of 1 lb. of chlorine. One pound of chlorine is sufficient for 1¾ lb. of copper as cuprous chloride and it is as cuprous chloride that the copper appears, in a clear water-white solution, after the removal of the iron. Sodium chloride is a cheap substance almost anywhere and in the cycle of operations but little of it is lost, and that incidentally. The process will, I believe, have wide application and patents have been procured in Mexico, Chile and Peru, as well as in the United States. Provisional protection has also been procured in Canada.

Riverside, Calif., Oct. 23, 1913. H. B. SLATER.

The Parral Tank

In the reference to the Parral tank which appears in the JOURNAL of Nov. 15, the following sentence may be the subject of misconstruction, viz.: "The Parral tank has had satisfactory experience in some places though it has occasionally failed to justify expectations."

I wish to say in reply to this that every installation designed by me when the character of the pulp was known has fully justified expectations so far as known to me. My confidence in the superior efficiency and economy of my system of agitation is evidenced by the fact that I do not ask anybody to pay anything until the system has been in commercial operation for 60 days, and if found unsatisfactory the system will be discontinued without any responsibility whatever. Of course this is predicated on my design of tanks and apparatus being followed in the installation.

BERNARD MACDONALD.

South Pasadena, Calif., Nov. 19, 1913.

Motor Trucks in Mining

With reference to the article on motor trucks in mining service, appearing in the JOURNAL of Sept. 18, 1913, I note that there is no mention of anyone trying them out in a district where the snowfall is heavy. I have seen suggestions by the manufacturers of fitting them with snow-ploughs, and clearing the roads after each storm, but do not know of it having been tried out in actual service. Any information your readers may have on the subject would be of interest.

F. CHARLES MERRY.

Ferguson, B. C., Oct. 31, 1913.

EDITORIALS

The Copper Statistics of November

The report of the Copper Producers Association for November, showing an increase of about 15,000,000 lb. in the stock, was about what was expected. The production was materially smaller than in the previous month, but still was not very much short of what the smelters, as distinct from the refiners, have been reporting on the average. Foreign deliveries increased a little, but domestic deliveries fell off largely.

The domestic deliveries reflect the filling of old contracts, and the falling off in their aggregate shows how those contracts are running out. It has never been at any time supposed that they ran extensively into December, and at this writing the sales books of the producers are believed to be pretty nearly bare. If no large buying movement should develop between now and the end of this month, the next report of the association might be expected to show domestic deliveries very small indeed. The great concern is as to just how much domestic consumption has fallen off and how long their previous over-anticipation of requirements is going to carry the copper manufacturers along. The mere fact that manufacturers have been able to stay out of the market for so long implies the probability of some buying movement soon unless the contraction in real consumption is much greater than anybody now supposes.

The statistics of foreign deliveries do not tell very much. There is suspicion that some of the copper that has been shipped abroad has gone on consignment, i.e., that it has not been sold for consumption, but has been shipped by the producers to European warehouses to be available subsequently when needed. The last statistical report from Europe showed an increase in the stock over there. However, none of our statistics include the copper afloat between America and Europe, nor do they indicate the "invisible supply" into which copper sent abroad on consignment sometimes goes.

A definite thing about the November report is that statistics and sentiment have fallen once more into step.

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The Recession in Business

All of the current commercial statistics are telling the now familiar story of increasing decline in business in the United States. Building expenditures are falling off, furnaces are going out of blast, the number of idle railway cars is increasing, men are being laid off in the factories, and so on. This condition of affairs naturally produces an atmosphere of gloom. There is, however, the consoling thought that it does not follow an economic crisis; nor does it portend one, according to financiers of experienced judgment.

On the contrary, the falling off in business appears to be due to perfectly natural and thoroughly understood causes. About this time last year, or a little earlier, conditions in Europe led to a great liquidation of American securities held over there, which we had to buy back, using up much of our capital in the process. Concurrently, there has been the distressing situation in Mexico, which has rendered hundreds of millions of dollars of our capital temporarily nonproductive. We have made a radical change in our tariff system, which inevitably caused some dislocation and disturbance of industry, although its final effect may be good, and probably will be good. We are even now confronted with prospective legislation remodeling our banking and currency system and other legislation affecting our corporation interests. This legislation may also be eventually for the good; there is ground to suppose that it will be, but the mere fact of an impending change cannot fail to be a disturbing factor. Any of these things would be alone sufficient to affect business. Operating together, they have had a cumulative and severe effect. The basis of encouragement is that these adverse factors are not of a nature to prevent a relatively quick recuperation from them.

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The Situation in Spelter

All of the metals have been weak, owing to the slackening in the demand for them, while in the case of copper, certainly, and in the case of lead probably, production continues undiminished. Somewhat different conditions prevail in spelter, which is rather more sensitive to changes in the market than are either copper or lead. The recession in the brass and galvanizing industries has of course reduced the consumption of spelter. For some time past, the largest buyers have been conspicuous in the market by their absence. In the meanwhile, the unsold stock in the hands of smelters has increased materially. Several interests have apparently uncomfortable accumulations.

Conditions are, however, being corrected in a natural and salutary way. The price has come down to a point where consumers may feel that they are safe in contracting for supplies, and sooner or later they will no doubt do so. The price for spelter may go lower yet, or may not, but the consumer who does not figure that he is enough of a prophet to discern the absolute bottom, and is content merely to buy cheaply when he can do so, finds his opportunity now. Experience and observation point to 5½c., St. Louis, as being about the average price for spelter, reasonably to be expected under existing conditions. When spelter falls a half a cent under that price it is cheap; at a half a cent above that price it is dear. When those limits are passed it becomes either very cheap or very dear.

The way in which the present position is regarded is best evidenced by the extent to which the smelters are putting their furnaces on dead fire, or closing their works entirely. It has been estimated by a well informed interest that at present not more than two-thirds of the total American smelting capacity is in use. Such a drastic restriction of production as is indicated by this will

rapidly correct the present bad features of the spelter market and put it in a position to respond promptly whenever a considerable buying demand develops.

From Europe we hear that the situation continues unsatisfactory over there, in spite of the restriction of production that has been going on for several months under the terms of the convention. The present convention expires early next year. Negotiations for its renewal have lately been going on, and it is considered probable that there will be a renewal. However, it is not considered likely that there will be any alteration of conditions that will permit a material advance in price in the near future. Anyway, that is the present view. If correct, we cannot, of course, have any great advance here. However, we may reasonably expect before long a rally to a figure that is nearer our normal average.

Opportunities in Mexico

A correspondent in the City of Mexico, a well known mining engineer, writes us that he thinks there will probably be a great deal of mining business done in Mexico during the next year, inasmuch as many properties are now being picked up, chiefly by well informed men who are not alarmed at temporary troubles.

It has always been foreseen that sooner or later there will be great opportunities for investments in Mexico on very advantageous terms, taking a long view of the future. There has been, necessarily, during the last two or three years, a liquidation of mines, real estate, and almost all kinds of property, which anybody wanting to buy could have almost at his own price. If there were a sure prospect of the restoration of a stable condition in Mexico, there would, of course, be a rush to buy. No such thing is to be anticipated right away.

The questions that bother the prospective investor are, whether the bottom of the depression has now been reached, or whether things will go still lower; and, finally, whether, after all, he has the nerve to take the chances, which now loom big, and the patience to wait.

Slime Tables

The concentration of ores by means of buddles and shaking tables is one of the oldest metallurgical arts and in its practice invention ought to be exhausted. But not so. About five inventors out of every ten have some new design in their heads, or so it seems, and scarcely a year passes without the production of some novelty, or may be some revival of an old idea, which proves to be worth while.

Just now the fashion seems to be running in the direction of multiple deck tables. This is no new idea, to be sure, the two-deck and three-deck round tables being familiar in the days of our youth, but nobody suggested anything so progressive as the 20-decker at Anaconda. That impressive construction is believed to be a great step toward the successful treatment of the Anaconda slimes.

Nor did anyone until lately, so far as we know, conceive a multiple-deck shaking table. These are now installed by the Deister and Wilfley, and perhaps other manufacturers. The Deister and Wilfley are six-deckers. In the Miami mill the Deister has been a successful and valued feature, the plans for increasing the capacity of the plant being based largely upon the saving of room that it effects.

Not even has the best form of riffle yet been devised. At Miami and at Morenci, Arizona, experiments have lately been made with improved arrangements, which are reported as giving wonderful results. Manifestly the design of ore-concentrating tables is far from being an exhausted art.

Lake Superior Wages

It has been reported during the last week that the mining companies of the Lake Superior region have granted their employees an 8-hr. day at a $3 minimum wage. Recognition of the union is, however, refused. In taking this course, the companies have bowed to the inevitable. The basis of the strike was always an economic condition. It was not so much a question as to whether the miners of the copper country were being paid a fair wage, or were in the enjoyment of good living conditions, as it was that the demand for mining labor was such that the best men could earn more money elsewhere. Labor is notoriously immobile, and naturally so. No man of family can lightly pull up his stakes and move elsewhere in order to take immediate advantage of market conditions. Unless the market conditions are recognized at home, however, he will be dissatisfied, will be disposed to join in a strike, and eventually will move out of the district if the strike be prolonged. The employers may carry their point, may break the strike, but they will find themselves short of labor in the end, and will have to meet the market in order to obtain the supply that they need.

This was the experience in the Bingham strike, and it is now the experience in the Lake Superior strike, just as we have repeatedly remarked that it would be. The mistake of the companies was in not recognizing the basic economic condition in the first place. In all other respects, the right was on their side, but it has been learned once more from this experience, as it has been from many previous experiences, that benevolence is not an asset in labor disputes. No matter how altruistically an employer may seek to improve living conditions, no matter how extensive may be his endowments of schools, hospitals and public improvements, the employee will reject them all and prefer to live amid conditions of discomfort, even of squalor, for the sake of a few cents more in the daily wage. In the Lake Superior dispute, altruism was on the side of the companies, but economics was against them, and economics prevailed as it always does.

The reduction in the tariff on most classes of iron and steel has had no appreciable influence on the trade so far, though it will undoubtedly have some influence in preventing an advance in prices when business begins to improve. There has been some offering of German iron and steel on the Atlantic Coast by foreign agents, but no actual selling of any amount. Conditions in the trade abroad are not as active or prosperous as they have been, and there is more surplus for export, but it does not seem to be coming this way. The only place where there has been any selling of foreign iron and steel, is on the Pacific Coast, where importers have always had their best chance, owing to the cheapness of water transit as compared with rail. Eastern manufacturers of bars and shapes have cut prices in California to points as low—in some cases lower—than at Pittsburgh, to meet this German competition. On the whole, it does not seem as if any large imports need be expected.

BY THE WAY

This is from a New Zealand mine inspector's report: "J. Brown had his leg broken by a truck of mullock being tipped on top of him while he was in a pass." Apparently, as Alice remarked after listening to the story of the Jabberwock's fate, "something happened to somebody."

⁂

In addition to the chemical elements usually recognized, *Science* states that Dr. A. Wegener has attempted to prove the existence of a gas "coronium" in the earth's atmosphere. According to his calculations it forms 0.00058% of the atmosphere at sea level; practically 100% at 400 to 500 km. altitude.

⁂

There has been formed in the city of Chicago and vicinity, an organization composed of men following the engineering profession, for the purpose of finding ways and means for the advancement of engineers' salaries and standardizing of positions. The organization is affiliated with the American Federation of Labor. Enough said.

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In a recent strike of miners in a Western district, the platform of the strikers was tersely summed up in the following placard:

THE BOSSES SAY: SPEED UP.
WE SAY: SLOW DOWN.
Then there will be work enough for everybody.

This is the philosophy of trade unions, and it has something to do with the high cost of living.

⁂

We have plenty of fiction in mining, but mining does not figure very well in fiction. It is a pity that Kipling never tried his hand at a mining story. Up to date Mrs. Foote's "Led Horse Claim," a story of Leadville, written in the '80s, is the best, we think. Mrs. Foote, by the way, is the accomplished wife of the general manager of the North Star mine, of California. Several new mining stories have lately come to our attention.

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"The Twins of Suffering Creek," by Ridgwell Cullum (George W. Jacobs & Co.), is a tale of a Montana placer mining camp, which is mainly concerned with the raising of twins, aged four, whose mother has bolted, leaving them with an incompetent father. The miners form a syndicate to furnish aid and advice. Of course, everybody becomes rich and happy in the end. There is some humor and some pathos in the story. The author might have done something worth while if he had had a consulting engineer and a competent editor. In the absence of such aid and advice, his work has rather a silly air and absurdity comes to a climax when a 10-ft. hole in a gold placer digging produces a petroleum gusher.

⁂

Another new story is "Gold," by Stewart Edward White (Doubleday, Page & Co.). Mr. White has already, in his "Westerners," displayed real knowledge of mining conditions in the West. Perhaps he will yet write the great American mining romance. "Gold" is a story of the rush to California in '49, and early experiences in San Francisco and the diggings. Mr. White describes the spread of the gold fever in New York, the slow filtering of the news of the discovery by roundabout channels, and the excitement that followed the first authentic announcement in a Baltimore newspaper. He takes a party of four adventurers from New York to California, via Panama, and describes their experiences on the way and in the gold diggings. He has manifestly studied history and contemporaneous authorities, for his work is characterized by simplicity and has every air of verisimilitude. It is the epic of California. We wish there had been more of it, and that it were not quite so sketchy.

⁂

A branch of the mineral industry that is seldom considered is the ice business. What has the ice business got to do with the mineral industry? will ask some of our readers. Well, ice is a mineral, is it not? See Dana. And was it not the late James D. Hague who remarked that the finest mine he knew of was the Hudson River, which had a vein of mineral, 1 ft. thick, 100 miles long, and half a mile to a mile deep, laid out flat, and yielding a concentrated product worth $3 or $4 per ton, with the further advantage that this sheet of mineral renews itself every year. Our remarks are prompted by reading somewhere that the manufacture of artificial ice in the United States now amounts to upward of 12,000,000 tons per annum.

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Mr. Mellen's remark that he never thought about his salary but just took what was given him led *Life* to make some characteristically pertinent remarks: The best workers do the work they like, and take the pay as it comes. Obviously, Mr. Mellen was far more interested in his job than in his salary, and the same is true of his successor, Mr. Elliott, and true of most men who are worth hiring at high wages. All the same it is better that valuable men should be liberally paid. It helps them to do their work and extend their influence, and that is worth while; it helps to make usefulness respected and popular, and that, too, is very suitable. It looks something like a toss-up whether salaries, big or small, will continue to be paid after this year. The difficulties of finding out how much is due on the income tax are so great, and the disputes about the processes of payment so fierce, that lazy people will be disposed to drop their incomes into Uncle Sam's hat and live on their principal while they still have it.

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The Mimbres Valley has about all metals that can be dug out of the rocks, including a huge mountain of tin that has recently been discovered by R. N. Hale, of Cameron, Tex., and William O'Toole, of Battle Creek, Mich., the latter having a parcel of land near Mirage, the first station out of Deming northeast on the Santa Fé. The boys were prospecting when they discovered the mountain of rock, which they supposed to contain tungsten. They sent samples for assay and found that instead of having tungsten they had a good proposition in tin, according to Texas newspapers. Further investigation was made, when it was found that there were practically three mountain peaks, embracing several hundred acres, that were composed mostly of heavy ore-bearing tin, which would produce not less than $100 worth of tin

per ton. One or two other samples were sent for assay and the result is all the same. According to the experts who have examined the properties there seems to be enough tin there to pay for a large smelter on the ground. The ore is also rich in manganese and silica. The black topped peaks can be readily singled out for five or six miles. At the present time there have been about two dozen claims filed and people are becoming interested every day. There are a few more claims that could be profitably filed upon. Hurrah for the ore rich in silica!

❖

Some time ago we reported that the Constitutionalists were coining money at Parral. Now it is said that a regular mint has been established, coining *pesos,* half *pesos* and *centavos* of intrinsic value greater than those of the Government mint. The rebel coins contain more silver and some even have a percentage of gold, refining facilities not being good. The rebels have melted all the trolley wires to make copper *centavos.*

❖

The Eastern Steel Co., Pottstowr, Penn., is experimenting with the use of pulverized bituminous coal as fuel in its openhearth furnaces, says the *Iron Trade Review,* but the company advises that these tests have not progressed sufficiently to warrant any positive statements being made as to their economic value. It will be probably some months before the adaptability of this fuel method to openhearth furnaces can be ascertained.

❖

A British Columbia newspaper reports that F. B. Allan, of Toronto, has told the Nelson Board of Trade that the problem of the treatment of complex zinc ores had been solved and that he is willing to demonstrate the process, which will save all the metals in the ore, at a cost of about $2 a ton. He suggests that from $15,000 to $20,000 should be raised to erect a plant on a commercial basis. This is important if he can do it. We don't believe, though, that any $20,000 plant is going to treat much ore at $2 per ton and extract all the metals.

❖

A few weeks ago we made some remarks about the deadly crosshead. A little while thereafter we observed the following press dispatch from Negaunee, Mich:

Thomas Garrett, Ishpeming, was killed and Fred Borlace was injured while being lowered to work in the new Breitung shaft. Garrett and Borlace were riding in a bucket and were down about 100 ft. when the cross-head fell, knocking Garrett to the bottom of the shaft and striking Borlace on the head.

This was apparently one of the loose variety and so ill-proportioned as to permit of its sticking between the guides.

❖

It is no new trick to keep compressed air from freezing at the exhaust of a machine by using salt. A similar method slightly more expensive, but involving certain advantages, has been tried for automatic riveting hammers used on outside work in winter. It consists in feeding small quantities of alcohol into the pipe line. The exhaust from machines thus treated is said to be in high favor with the riveters. Whether it has an exhilarating effect and whether this results in more work or in erratic work is not stated. When labor is scarce and particular, some device of this nature might help to keep machinemen on the job. Instead of using pure alcohol, equally good results should be obtainable with some of the aromatic distillates which contain alcohol in high percentages.

❖

John Hays Hammond, speaking at the closing session of Clark University Conference on Latin America, declared that he would not invest a cent in a foreign country as long as William J. Bryan is Secretary of State. "A nation that does not protect its citizens and investors is unworthy of the name of a nation," said Mr. Hammond, after remarking that honest workingmen, encouraged to locate in Mexico, are forced to throw away the savings of a lifetime. "They are told to get out, flee the country where their all is located," said he. "As an argument against protection for some property, it has been claimed that concessions have been secured dishonestly. I have never known of bribes being offered or taken for concessions. Investors ought to be backed and protected as long as they prove honest."

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According to Mexican dispatches the Constitutionalists are now operating trains on the lines of the National road from Santa Rosalia to Torreon, Torreon to Durango, Durango to Tepehuanes, Durango to Llano and Durango to Lodemena. They have no coal or oil, so they are using wood as fuel and the service is good, although many difficulties have to be contended with. We are glad to hear that all the mines around Durango are in a flourishing condition and work is being continued. As money is scarce, the mine owners are giving notes to the workers which will bear interest until the reëstablishment of regular railroad traffic. The miners report that the large properties of the American Smelting & Refining Co. near Velardeña have not been touched by the rebel forces operating in that region. The smelters are not working because of a lack of coal.

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At the Alaska Gold Mines Co. property some operating records are being made which have amazed the mining fraternity—those who know what a slow and tedious process is the driving of a tunnel in solid rock, says the *Boston News Bureau.* The general manager of the Alaska Gold Mines Co. is driving an 8x10 opening at the rate of 600 ft. per month and in so doing has devised a schedule of hours for his underground men which is most ingenious in that it provides for 48 hours' work every week and yet the miner does not work more than six hours per shift. It is six hours on and 12 hours off right through the week. The miners seem as enthusiastic as their superintendents in making new records and work under what approaches military discipline. A drill man, for instance, does not release his hand from an air-drill at the end of a shift until his successor has actually taken hold of the same machine, and is ready to take up the work where it is left off. This may seem like drawing the lines pretty fine, but in the end it means maximum efficiency. The scheme referred to follows:

	On Duty	Off Duty
Monday	6 a.m. to 12 noon	12 noon to 12 midnight
Tuesday	12 midnight to 6 a.m.	6 a.m. to 6 p.m.
Tuesday	6 p.m. to midnight	12 midnight to 12 noon
Wednesday	12 noon to 6 p.m.	6 p.m. to 6 a.m.
Thursday	6 a.m. to 12 noon	12 noon to 12 midnight
Friday	12 midnight to 6 a.m.	6 a.m. to 6 p.m.
Friday	6 p.m. to 12 midnight	12 midnight to 12 noon
Saturday	12 noon to 6 p.m.	6 p.m. to Monday 6 a.m.

Report of the Geological Survey

WASHINGTON CORRESPONDENCE

The annual report of the Geological Survey made public on Dec. 8 covers all of the usual topics customarily dealt with by the Bureau and in addition offers a general discussion of the question of efficiency in the survey. On that subject the director speaks as follows:

In the Geological Survey, as in other bureaus of the Government, the endeavor to administer public funds economically is distinctly hampered by statutory and other limitations. In the thirty-third annual report detailed mention was made of the loss of efficiency, as well as danger to life and property, resulting from the crowding of a large office force and a great accumulation of technical records in utterly inadequate quarters. Since that report was published Congress has authorized the erection of an office building of modern type to accommodate the Geological Survey, Office of Indian Affairs, Reclamation Service, Bureau of Mines, and other offices of the Department of the Interior, with a cost limit, exclusive of site, of $2,596,000. On June 13, 1913, the Secretary of the Treasury included in the current deficiency estimates an item of $25,000 to provide for technical and engineering services in the office of the Supervising Architect in preparing plans for the building and for beginning its construction. It is to be noted that the same estimates include an item of "$99,261.83 to replace property and equipment destroyed by the fire of May 18, 1913, in the basement of the building now occupied by the Survey."

Another efficiency limitation of quite a different type from that imposed by inadequate and dangerous quarters is presented in the restrictions placed in one way or another upon the selection of personnel. Under "lump sum" appropriations there is a fair opportunity to obtain high-grade service in the scientific and technical positions, yet even here the restraining influence of precedent prevents attaching to the higher positions salaries that are more than a fraction of those which the well trained specialists best fitted for those positions can obtain for similar work in the service of corporations. This condition has resulted in many of the members of the Geological Survey leaving Government service at the time when they have become most valuable as public servants.

❖

Goldfield Consolidated

During October, 1913, the Goldfield Consolidated produced 30,486 tons of ore from which $146,918 was realized. Development work amounting to 3088 ft. was accomplished. The combined operating costs were as follows:

COST PER TON

Mining:	Mines Co.	Milling and Trans. Co.	Total
Stoping	3.02	....	3.02
Development	0.56	....	0.56
Shipping expense	0.23	....	0.23
Dump moving	0.04	....	0.04
Transportation	....	0.08	0.08
Milling	....	1.75	1.75
Marketing	....	0.04	0.04
General expense	0.28	0.05	0.33
Bullion tax	0.13	....	0.13
Construction	....	....	....
Flood damage	0.01	....	0.01
Total costs	4.27	1.92	6.19
Miscellaneous earnings	0.07	0.01	0.08
Net costs	4.20	1.91	6.11

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The Rio Tinto Strike

The British and Spanish newspapers now coming to hand are beginning to give us some details of the late strike in the Rio Tinto mines. It appears that the strike was engineered by professional agitators who had been sowing seeds of dissatisfaction in the district for many months previous. The strike which began on Sept. 15 affected not only the mines, but also the railway, shops and the docks of Huelva. Altogether, about 17,000 men quit work. The demands of the strikers were an 8-hr. day for everybody, a general increase of 25% in wages with a minimum of 4 *pesetas* per day, and an abolition of contract work.

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Status of Oil Land Prosecutions

WASHINGTON CORRESPONDENCE

Attorney-General McReynolds in his annual report sent to Congress on Dec. 10 gives a review of the situation with reference to the oil-land prosecutions which the government has been carrying on for some time past and which are now in a somewhat difficult position on account of claims under the mining laws. The attorney says in part on this subject:

On Sept. 27, 1909, and on several dates subsequent thereto, but prior to the approval of the act of June 25, 1910 (36 Stat., 847), which expressly declares the authority of the President to make temporary withdrawals of public lands for public purposes, a number of Executive orders were promulgated by direction of the President reserving immense areas of public petroleum lands in California, Wyoming, and other States from location, settlement, selection, filing, entry, or disposal under the mineral or non-mineral public-land laws. These reservations were generally disregarded in California, also in Wyoming, and perhaps elsewhere. It is charged that a large part of the most valuable public oil lands sought to be reserved has been entered upon and is now being claimed by individuals and corporations under the mining laws. Much of the land has been exploited for its oil, and large quantities have been extracted and are being extracted from day to day in the State of California. To remedy this condition, three suits were begun against important operators in that state and a fourth in Wyoming, and many others are in prospect. The suit in Wyoming, being free from disputes of fact and other complications which embarrass the California litigation, was selected for the purpose of securing a speedy judicial determination of the President's authority to make the withdrawals. The bill was filed in February last; a motion to dismiss was interposed by the defendants late in March; the motion was argued and submitted in May; and on June 14 the district court rendered its decree dismissing the bill, upon the ground, as set forth in an accompanying memorandum, that the order of the President was ineffective to prevent the lawful location of the land in controversy under the mining laws. An appeal to the Circuit Court of Appeals for the Eighth Circuit was promptly sued out, and that court, early in October last, certified the principal questions to the Supreme Court for answer. Upon motion of the Solicitor General the Supreme Court directed the sending up of the whole record, and has advanced the cause for hearing in January next.

Special counsel have been employed to conduct the cases pending, and other cases it may be necessary to institute in California, Wyoming, or elsewhere, for the protection of withdrawn areas of oil land and also to secure accountings for oil wrongfully converted.

The principal suit concerning lands situated in the Elk Hills in the southern district of California, mentioned in the report for the last fiscal year, is almost ready for final hearing. Substantially all of the defendants' testimony and the Government's testimony in rebuttal has been taken, and it is hoped that in the very near future it will be possible to argue the case on its merits and obtain an adjudication.

The last report spoke of prospective litigation of great importance respecting oil lands in California claimed by the Southern Pacific Railroad Co. under patents containing express exceptions of all mineral lands other than iron and coal lands. The work of preparation then referred to was completed during the last fiscal year, as to one of the patents, which affects more known oil land than any of the others, and on Dec. 20, 1912, suit was instituted asserting title to approximately 46,000 acres. This suit is pending on motions to dismiss the Government's bill of complaint upon the general grounds that were urged in the private suit of Burke v. Southern Pacific Railroad Co. et al., now pending in the Supreme Court, and referred to in the last annual report. Suitable provisions have been made to expedite the litigation to bring new suits, and to protect in every practicable way the Government't rights in the land and to the oil which has been and is being extracted from certain parts of it.

PERSONALS

Kirby Thomas, of New York, is making examinations in Tennessee.

M. L. Requa, of San Francisco, spent a few days in New York this week.

B. B. Thayer has been nominated to be the next president of the American Institute of Mining Engineers.

Allen H. Rogers has gone to Tennessee on professional work. He will return about the middle of December.

F. Danvers Power, of Sydney, Australia, who has been visiting in the United States, proceeded to London last week.

Herbert Haas, of San Francisco, has been appointed metallurgical engineer to the United States Bureau of Mines.

George W. Conant has returned to Lowell, Mass., after spending a year as electrician to the Arctic Coal Co., on the Island of Spitzbergen.

W. J. Hilands has returned to New York from Paris, where he has been in connection with the financing of a western iron development project.

Henry C. Carr has returned to New York from Ontario where he has been engaged with the Canadian Mining & Exploration Co., of New York and Toronto.

H. C. Hoover will arrive in New York per "Mauretania" about Dec. 13. He will remain in New York a week or 10 days and then will proceed to California.

C. C. Ferguson, lately with the Oliver Iron Mining Co., has been engaged as consulting engineer of the Iron Mountain mine on the Cuyuna range, Minnesota.

A. A. Hassan has left for Arizona to study and examine placer gold deposits and other mines in Mohave County. His headquarters will be in Kingman for some time.

Prof. H. O. Hofman's new treatise on "General Metallurgy" is to be translated into German. The manuscript of his new treatise on the "Metallurgy of Copper" goes to the publishers this month.

J. R. Finlay expects to be in New York during December but will return again to the lead district of Southeastern Missouri where he is engaged on important work for the St. Joseph Lead Co.

George Blow has opened an office at Knoxville, Tenn., for the general practice of mining engineering with special reference to examining and reporting upon the mineral and natural resources of the South.

Philip H. Moore, lately manager of the mining, crushing and cement machinery department of the Canadian Allis-Chalmers, Ltd., has been appointed general manager of Rock & Power Machinery, Ltd., with head offices at Toronto.

Stanley C. Sears, consulting mining engineer and metallurgist, has opened an office at 705 Walker Bank Building, Salt Lake City, Utah, and is prepared to examine and report upon mining properties and to undertake their management.

Thomas C. Keefer, of Ottawa, Canada, who a short time since entered his 93d year, has been elected an honorary member of the American Society of Civil Engineers, of which he was at one time president. A few months since the Institute of Civil Engineers of England also made him an honorary member.

OBITUARY

Samuel H. Gilson, for over 30 years a miner and prospector in Utah, died at Salt Lake City, Dec. 2 Mr. Gilson, while prospecting on the Uintah reservation in Utah some 25 years ago, discovered the mineral which was named gilsonite after him, and which has since been of considerable importance.

David A. Harris died Dec. 1 at Johnstown, Penn., aged 70 years. He was born at Hollidaysburg, Penn., and when still a young man entered the service of the Cambria Steel Co., with which he was connected over 40 years. For more than 20 years past, he had been head of the time and production departments.

John McMahon, formerly a prominent mine operator of the San Juan district, Colorado, died at Los Angeles, Calif., Nov. 16. He was born in Orange County, N. Y., and went West in 1874, locating at Georgetown, Colo., where he became associated with the Pelican-Dives mine, which at that time was one of the famous mines of the West. In 1876, he journeyed by horseback from Denver to Lake City, going by way of Cañon City, Salida, Poncho Pass and Del Norte. In the fall of 1877 he undertook the management of the Aspen mine at Silverton and remained in charge until the following spring; from there he went to Leadville and returned to Lake City. He was appointed special deputy to take charge of the notorious criminal Packard in 1884 and shielded him from the hands of mobs bent upon lynching. At various times he was at some of the famous producers of the San Juan district and was in charge of the Humboldt in 1902. He was an honest man in his dealings and was fearless in his duties, and was held in highest esteem by all his friends and acquaintances.

Dwight A. Jones died in St. Louis Dec. 7. He was a resident of New York, but was stricken with apoplexy while visiting St. Louis on business. He was 59 years old, and was born at Utica, N. Y., graduated from Yale, and studied law at the Columbia Law School in New York. He was a practicing laywer for a number of years, devoting himself chiefly to corporation law, on which he wrote several works which are accepted as authority. In 1904, he succeeded his father, the late J. Wyman Jones, in charge of the important lead interests which the latter owned in Southeast Missouri. He was president of the St. Joseph Lead Co., the Doe Run Lead Co., and the Mississippi & Bonne Terre Ry. At the time of his death, he was arranging for a consolidation of his companies. Mr. Jones lived at Englewood, N. J., and was a member of a number of clubs. He leaves a widow and three daughters.

Maurice B. Patch died Dec. 2, while on a visit to his son-in-law at Derby, N. Y. His residence was in Buffalo. He was born at Otisfield, Maine, in 1852, and in 1872 graduated from the Massachusetts Institute of Technology as a mining engineer. His first appointment after graduating was as deputy U. S. engineer for the territory of Colorado. In 1874, however, he went to the Lake Superior copper country, and from that time on was engaged in the treatment of Lake Superior copper ores. For eight years he was chemist of the old Detroit & Lake Superior Copper Co. In 1882, he was made assistant superintendent and constructing engineer for that company. In 1886, he was appointed superintendent of the smelting works of the Calumet & Hecla Copper Co. at Lake Linden, Mich. In 1891, he was placed in charge of the Buffalo Smelting Works of the Calumet & Hecla as superintendent, retaining that position ever since. It need hardly be said that he was thoroughly versed in the treatment of lake ores and that his opinion on all questions connected with copper smelting was highly considered. He leaves many friends in the Lake Superior country and elsewhere. He leaves a widow, three daughters and two sons.

SOCIETIES

Mining and Metallurgical Society—The New York Section will hold its regular monthly meeting at the Engineers' Club, Thursday, Dec. 18, at 8 p.m. The meeting will be preceded by a dinner (informal) at the Club. At the meeting the subject of discussion will be the "One Man Drill." R. M. Catlin, general manager of the Franklin mine of the New Jersey Zinc Co., will open the discussion.

University of Toronto Engineering Society—A dinner under the auspices of this society was given in Toronto, Dec. 5, in celebration of the 50th anniversary of the entrance to the University of Dr. John Galbraith, dean of the Faculty of Applied Science, and the 35th anniversary of his founding the School of Practical Science. F. C. Mechin, president of the Society, occupied the chair and about 500 engineers and others from all parts of Canada and several from the United States were present. The speakers included Hyndman Irwin, President Falconer of the University, G. M. Smythe, Col. W. N. Ponton, and Eric Phillips, who spoke in terms of high appreciation of the work accomplished by Dean Galbraith in the cause of scientific education and research.

American Museum of Safety—The jury of award, consisting of Professor F. R. Hutton, W. H. Nichols, B. B. Thayer, Dr. N. E. Ditman, and Arthur Williams, announces the annual medals of the Museum for 1913, as follows: The "Scientific American" medal for safety devices invented within three years to the Welin Marine Equipment Co. The Dr. Louis Livingston Seaman medal for progress in hygiene and sanitation and mitigation of occupational diseases, to the United States Steel Corporation. The Rathenau medal to the General Electric Co. The Travelers' Insurance Co. medal to the American employer who has done the most for the protection

of his workpeople, to the New York Telephone Co. An additional special medal is awarded the Allgemeine Elektricitäts Gesellschaft of Berlin. The jury has not yet decided on the award of the E. H. Harriman memorial medal.

INDUSTRIAL NEWS

The main sales office of the Carbo Steel Post Co. will, from Dec. 1, be in the Rand-McNally Building, Chicago.

Pacific Tank & Pipe Co. announces the removal of its San Francisco sales office from Fifth and Bryant Streets to 318 Market St., San Francisco, Calif.

The Remington Arms-Union Metallic Cartridge Co., of Bridgeport, Conn., has started work on its new Canadian plant at Windsor, Ont.

The Sullivan Machinery Co. desires to announce that John Oliphant, for many years president of the Harris Air Pump Co., of Indianapolis, has joined its engineering staff and will have charge of its pneumatic pumping department.

A new company, the Eastern Car & Construction Co., under the leadership of W. E. Farrell, has purchased the business of the Ernst-Wiener Co., and will hereafter sell that well known line of industrial railway equipment under the new name.

Harold D. Tompkins, formerly associated with the Niles-Bement-Pond Co., of Philadelphia, has accepted the position of mechanical engineer with the Smooth-On Manufacturing Co., Jersey City, N. J. He has charge of the concrete-waterproofing department.

Hardinge Conical Mill Co., 50 Church St., New York, N. Y., reports the order of two 6-ft. Hardinge Pebble Mills from the Bunker Hill & Sullivan Mining & Concentrating Co., of Kellogg, Idaho. This company is already operating four units of this size. This company also reports the order for two sectionalized mills for the interior of South America and two of the largest size 8 ft. by 30 in. mills for the Silverton Mines, Ltd., of Silverton, B. C., which company is installing the flotation system.

TRADE CATALOGS

John A. Roebling's Sons Co., Trenton, N. J. Catalog. The Wire Rope at Panama. 10 pp.; illus.; 9x12 in.

Wood Drill Works, 30-36 Dale Ave., Paterson, N. J. Catalog. Rock drills. Illus., 32 pp., 6x9 inches.

The Gardner Governor Co., Quincy, Ill. Circular P-8. Gardner duplex power pumps. Illus., 8 pp., 6x9 inches.

The Lunkenheimer Co., Cincinnati, O., Booklet, Lunkenheimer Regrinding Valves: 24 pp. Illus. 6x3½ inches.

Crocker-Wheeler Co., Ampere, N. J. Bulletin No. 160. Induction motors for general use. Illus., 20 pp., 7x10 inches.

Allis-Chalmers Co., Milwaukee, Wis. Bulletin No. 1805. Hoisting cages, skips, landing dogs, etc. Illus., 28 pp., 8x10½ inches.

C. O. Bartlett & Snow Co., Cleveland, Ohio. Catalog No. 42. Triumph crushers, feeders, pulverizers. Illus., 32 pp., 6x9 inches.

Sprague Electric Works, 527-531 W. 34th St., New York. Bulletin No. 247. Round type direct current motors. Illus., 24 pp., 8x10½ inches.

Bernard MacDonald, 1005 Fair Oaks Ave., South Pasadena, Calif. Booklet, The Parral Tank System of Slime Agitation: 36 pp. Illus. 9¼x6 inches.

Chicago Pneumatic Tool Co., Fisher Building, Chicago, Ill. Bulletin No. 34-D. "Chicago Pneumatic" Corliss steam driven compressors. Illus., 32 pp., 6x9 inches.

Smooth-On Mfg. Co., 572-574 Communipaw Ave., Jersey City, N. J. Circular. Smooth-On Iron Cement No. 7 for surfacing and stopping leaks in concrete. Illustrated.

The Cincinnati Milling Machine Co., Cincinnati, Ohio. Catalog. Cincinnati Semi-Automatic Millers with Intermittent Feed and Power Quick Return. 16 pp.; illus.; 7½x11 in.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

OIL-BURNING FORGE. John George Leyner, Denver, Colo., assignor to The J. Geo. Leyner Engineering Works Co., Littleton, Colo. (U. S. No. 1,078,154; Nov. 11, 1913.)

CRUSHING—Improvements in Mills or Apparatus for Reducing Ore or Other Materials. R. Rodger, Knigersdorf, Transvaal. (Brit. No. 21,069 of 1912.)

ORE SEPARATOR. Fritz Oscar Stromborg, Seattle, Wash. (U. S. No. 1,078,520; Nov. 11, 1913.)

BRIQUETTES—Process of Making Briquettes of Fine Ores. Otto Kippe, Osnabrück, Germany. (U. S. No. 1,078,544; Nov. 11, 1913.)

COPPER-SMELTING FURNACES, Improvement in. W. G. Perkins, London, Eng. (Brit. No. 27,869 of 1912.)

AMALGAMATOR. Jacob Isaac Anderson, Prescott, Ariz. (U. S. No. 1,079,534; Nov. 25, 1913.)

CYANIDING — Filter-Leaf. Charles Butters, Oakland, Calif. (U. S. No. 1,078,993; Nov. 18, 1913.)

CYANIDING—Process of Dislodging Slime Cakes from Filter Media. Charles Butters, Oakland, Calif. (U. S. No. 1,078,994; Nov. 8, 1913.)

REGENERATIVE FURNACES—Improvements in and Relating to the Operation of Regenerative Furnaces Adapted More Specifically for the Manufacture of Steel. N. E. Maccallum, Phoenixville, Penn. (Brit. No. 30,079 of 1912.)

SINTERING—Method of Treating Materials for Sintering. Quincy Bent and Edwin Barnhart, Sparrows Point, Md., and James B. Ladd, Ardmore, Penn. (U. S. No. 1,078,988; Nov. 18, 1913.)

TENSILE STRENGTH OF IRON—Method of Treating Iron to Increase Tensile Strength. John Kirby, Pittsburgh, Penn. (U. S. No. 1,079,129; Nov. 18, 1913.)

ALUMINUM—Improvements in the Production of Aluminous Compounds. H. Spence, W. B. Llewellyn and Peter Spence & Sons, Ltd., Manchester, Eng. (Brit. No. 22,590 of 1912.)

ALUMINUM-BEARING MATERIALS, Treatment of. Harry P. Bassett, Catonsville, Md. (U. S. No. 1,079,589; Nov. 25, 1913.)

ALUMINUM NITRIDE—Process for the Manufacture of Aluminum Nitride. Ottokar Serpek, Paris, France, assignor to Société Générale des Nitrures, Paris, France. (U. S. No. 1,078,313; Nov. 11, 1913.)

LEAD OXIDE—Improvements in or Connected with the Production of Lead Oxide and in Means or Apparatus Employed Therein. W. Innes, Liverpool, Eng. (Brit. No. 15,664 of 1912.)

MAGNESIUM—Process for the Preparation of Metallic Magnesium. Roger William Wallace and Eugène Wassmer, London, England. (U. S. No. 1,079,079; Nov. 18, 1913.)

BLASTING—Mine-Shot-Firing System. Grant I. Rawson, St. Louis, Mo. (U. S. No. 1,078,463; Nov. 11, 1913.)

DRILL—Hammer Drill. William Prellwitz, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,078,952 and 1,078,953; Nov. 18, 1913.)

DRILL—Percussive Tool. William Clement, Phillipsburg, N. J., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S No. 1,078,188; Nov. 11, 1913.)

MINE PUMP. Lewis Chadwick, Nelsonville, Ohio. (U. S. No. 1,078,126; Nov. 11, 1913.)

CENTRIFUGAL SCREEN AND CLASSIFIER. Christ Bartholomai, Los Angeles, Calif. (U. S. No. 1,078,819; Nov. 18, 1913.)

CONCENTRATING JIG. Marshal C. Seagrave, Oakland, Calif. (U. S. No. 1,079,905; Nov. 25, 1913.)

CONCENTRATOR—Multiple-Deck Concentrator. Albert E. Wiggin, Anaconda, Mont., assignor of one-third to Ulysses A. Garred and one-third to Frederick Laist, Anaconda, Mont. (U. S. No. 1,078,977; Nov. 18, 1913.)

ORE CONCENTRATION. George Albert Chapman and Stanley Tucker, London, England, assignors to Minerals Separation, Ltd., London, England. (U. S. No. 1,079,107; Nov. 18, 1913.)

ORE FEEDER and Sampler. Walton Lake Morehouse, Madera Mexico. (U. S. No. 1,079,184; Nov. 18, 1913.)

ORE SEPARATOR. Albert M. Plumb, Platteville, Wis. (U. S. No. 1,079,362; Nov. 25, 1913.)

PULP DISTRIBUTOR. Wilton E. Darrow, Sutter Creek, Calif. (U. S. No. 1,078,775; Nov. 18, 1913.)

SAMPLER-OPERATING DEVICE. Laban E. Jones, Anaconda, Mont. (U. S. No. 1,079,010; Nov. 18, 1913.)

CHARGING—Apparatus for Charging Furnaces or Ovens. Utley Wedge, Ardmore, Penn. (U S. No. 1,079,081; Nov. 18, 1913.)

COMPLEX ORE TREATMENT—Process for the Treatment and Separation of Complex Sulphide Ores. Tormod Reinert Forland, Broken Hill, New South Wales. (U. S. No. 1,078,779; Nov. 18, 1913.)

GAS PURIFICATION—Purification of Gases Containing Sulphur Dioxide. Rudolph Messel, London, England, assignor, by mesne assignments, to General Chemical Co., New York, N. Y. (U. S. No. 1,078,937; Nov. 18, 1913.)

PREHEATER and Furnace Shield. Walter S. Rockwell, New York, N. Y. (U. S. No. 1,079,266; Nov. 18, 1913.)

REFRACTORY MATERIAL. Frank J. Tone, Niagara Falls, N. Y., assignor to the Carborundum Co., Niagara Falls, N. Y. (U. S. No. 1,078,525; Nov. 11, 1913.)

EDITORIAL CORRESPONDENCE

DENVER—Dec. 6

In the Coal Miners' Strike the operators and the United Mine Workers are practically agreed on all controversial points except two, wages and union recognition, and these two are properly and indisputably subjects for arbitration and this is now absolutely essential to the settlement of the trouble. The coal operators have agreed to all the other points in the controversy, supported by their assurance to Governor Ammons that they will conform to them in good faith as follows: The employment of a check weighman as provided by law, giving the miners themselves the right to choose their own check weighman. The carrying out in good faith, the statute making it unlawful to use or employ, directly or indirectly, the so called "truck" or "scrip" system in the payment of men. The enforcement of the law for an eight-hour day at all underground mines and coke ovens, as provided in Chapter 95 of the session laws of 1913. That all employees shall have the right to buy where they will, without interference or coercion of any kind whatsoever. That all employees shall be paid semi-monthly, according to the custom now prevailing in coal mines over most of the state. That all employees shall have the right to board where they please. The enforcement of all the provisions of the coal-mine inspection law of 1913, providing for the safety of the mines and the protection of the life and health of the employees. That all employees now on strike shall be given employment except where their places have been filled or where they have been guilty of violence or other unlawful acts; and that where they have been guilty of violence or other unlawful acts, and that where places have been filled, other work will be furnished as soon as practicable. But the mine workers continue to reject all propositions and to make recognition of the union a paramount demand. However, Nov. 28, as a supplemental proposition Governor Ammons and Secretary of Labor Wilson joined in the following request: That the proposition of the coal operators, as contained in the memorandum of Governor Ammons, dated Nov. 27, be agreed to by the miners. That the following disputed questions be referred to a board of arbitration: (a) The question of an increase in wages. (b) In lieu of the proposition of recognition of the union, the question of devising a method by which future grievances and disputes may be adjusted without resorting to strikes. The board of arbitration is to be composed of seven members, three to be selected by the operators, three by the miners, and the six to select the seventh member of the board. Should the six fail to agree on the seventh then President Wilson shall select him. This board, should it be organized, is to render its decision within 60 days, its findings on the question of wages to be effective from the date of resuming work. Pending the decision of the board work will be resumed in the mines. In view of the great distress that this industrial war is causing to thousands of citizens and of the fact that it is injuring the property of the state, it was hoped that both sides would accept this counsel of the governor of the state and Secretary of Labor. On Dec. 1, however, after a conference with Governor Ammons, Secretary Wilson sent a letter to the miners and operators withdrawing the joint proposition for arbitration of the strike situation, pending a referendum vote by the miners on the proposition of the governor, which the miners' committee then assured Secretary Wilson would be called out of courtesy to him as soon as possible, wage increase and recognition of the union to be excluded on the proposal for referendum test. The United Mine Workers and the State Federation of Labor, and Mother Jones, who has returned here from Washington, are busy, and it is announced from union headquarters that prominent speakers have been engaged to carry on an active campaign for a state-wide sympathetic walk-out. Mother Jones, abusive and violent as usual in her talk, characterizes Governor Ammons as a "moral coward" and "a time server for the interests." Twenty-five indictments against national and state officers of the United Mine Workers were returned by the federal grand jury Dec. 1, at Pueblo. The charges against them were for "maintaining a monopoly of labor," and "for conspiracy in restraint of trade." The criticism of the jury was strong, the report declaring that their methods are "an insult to conservative and law-abiding labor." "They have brought experienced strike agitators into the state," the report says, "and have armed hundreds of irresponsible aliens, who have become a menace to the peace and prosperity and even the lives of our citizens." "They created open insurrection in southern Colorado and have resorted to measures which all fair-minded labor organizations repudiate." No arrests were made and they will be given reasonable time to furnish bonds. On Dec. 3, the call for a convention to be held in Denver to issue the order for a state-wide walk-out of all organized craftsmen in support of the striking coal miners, was issued by the president of the State Federation of Labor, and it will be held Dec. 16. Every union in the state will be represented, including trainmen. The proposition of Governor Ammons for a settlement of the coal strike was rejected Dec. 2 by nearly a unanimous vote of the striking miners; 9000 men balloted on the question. The next step is for the secretary and governor to resubmit jointly their arbitration proposal, which was temporarily withdrawn that the vote on the terms offered by the governor might be taken. It is expected that a vote on the arbitration question will also be asked.

BUTTE—Dec. 3

In Northern Pacific Minerals Rights Case an oral opinion was handed down Nov. 26, at Helena, to the effect that the railway company will have to pay taxes in Montana on the mineral rights which it has reserved in its deeds to agricultural lands.

The Anaconda and Butte-Ballaklava Settlement of their differences, of three years' standing, concerning a vein adjoining the Mountain Chief claim of the Anaconda company, is believed to be an important step toward the abandonment of the complex apex system of vein ownership in Montana in favor of vertical-plane ownership of orebodies within claim boundaries. By the terms of the agreement made out of court the Ballaklava property, which has been idle under injunction for three years, may begin mining ore immediately. All charges and claims made by the Anaconda company have been dismissed and the Ballaklava company is allowed undisputed possession of all veins and portions of veins inside a vertical plane dropped from the surface boundary between the Butte-Ballaklava, and adjoining Mountain Chief claim on the north. It gives the Butte-Ballaklava company as much of the vein in question as a favorable court decision would have, and also the downward extension of the vein to an estimated depth of 3000 ft. or more. The Anaconda company agrees that any portion of the Mountain Chief vein lying north of the Ballaklava vein, if at depth is found to dip inside the latter's ground, shall, within the vertical-plane boundary, be the property of the Butte-Ballaklava company.

The Montana Power Co. Hearing, which had been postponed from Nov. 13, was resumed Nov. 29 before the state public service commission at Helena. L. O. Evans, attorney for the defendant, stated that his client took the same stand in the matter as outlined at the former meeting, namely that it was not prepared at this time to introduce evidence bearing upon the reasonableness or unreasonableness of the rates, as the valuation of the company's property, now being made, would not be completed for six months yet, but expressed the hope that the investigation of the company's books by the commission's accountant and engineer, which had been under way for the last two weeks, would be convincing proof of the fairness of the company's request for additional time. Commissioner Morley, in behalf of the commission, stated that from the findings of the accountant and engineer, they believed the rates to be excessive and felt they had sufficient evidence on which to base an order for a reduction. He went on to say that the commission had prepared a new schedule which it would like to have go into effect Dec. 1, but first wished to know if it would demoralize the company's accounting department to order them in so abruptly. Attorney Evans replied that although the company was not enthusiastic over any change, still if the rates were to go into effect in a month or two anyway it was immaterial whether it was done at this time or later. In introducing the new schedule which calls for a considerable cut in electric-lighting rates in 31 cities and towns in the state, the commission stated that the greatest reductions were

made on business and residence rates, as the old power rates were for the most part considered reasonable and fair. It further stated that from records of investigations made by other public service commissions it is shown that it does not follow that the power company's earnings will be decreased proportionally to the reduction of the rates, as the commission was of the opinion that the reduced rates will result in some increase in the amount of business done. In four of the larger towns of the state, Butte, Great Falls, Livingston and Bozeman, an average reduction of a little over 19% will be made. In Butte the old rate will be reduced from gross, 13.5c.; net, 11.8c. per kw.-hr.; to gross, 10c.; net, 9½c. per kw.-hr., the gross reduction being 26% and net, 19½%.

SALT LAKE CITY—Dec. 3

A Metallurgical Research Station at Salt Lake City is provided for in a bill introduced by Congressman Howell, of Utah. It is to be maintained jointly by the Federal Government and the state, and is already in operation, though the organization has not been completely effected. Under the arrangement with the Government, the state will furnish $7500 annually for the maintenance of the station, and the Government will pay the salary of the director, which will be $4000. Examinations for this position were held Nov. 10, and applications are being considered by the Bureau of Mines.

Suit of the Majestic Mining Co., operating in Beaver County against the Miners' Smelting Co., controlled by F. A. Heintze, was settled Nov. 28, by the payment of $21,000 to the plaintiff. Judgment was awarded the Majestic company and execution issued last June. Following the recent payment, the case was dismissed from the Federal Court. In the suit the Miners' Smelting Co. was characterized as a dummy corporation. This company leased the Majestic smelter near Milford, and secured a favorable contract on Silver King Coalition ores, which it later turned over to another smelting company.

CALUMET—Dec. 9

An 8-Hr. Day and $3 Minimum Pay for underground employees has now been granted to the striking copper country miners so that all the demands made by the federation at the beginning of the strike have been conceded except recognition of the union. On Dec. 7 two strike breakers were shot to death and a third was so seriously wounded that he died that night in an attack made on a non-union boarding house at Painesdale by the strikers. A 14-year old girl was seriously wounded as she lay in her bed. The miners, armed with guns and carrying much ammunition, surrounded the house at 4 a.m., while everybody inside was asleep and opened fire. They riddled the sides of the house with bullets. Some of the clapboards looked like sieves when the firing ceased. Those who were shot were either wounded in their beds, the strikers taking particular care to fire into bedrooms, or they were seeking shelter in halls and closets. At a meeting Dec. 7, of the Citizens Alliance, a resolution was adopted calling upon Sheriff Cruse to relieve the district of strike agitators. A threat was made that the alliance would "take other means" unless the sheriff acted. The impeachment of Judge O'Brien, Sheriff Cruse and Prosecutor Lucas was also threatened for what the speakers called the dilatory handling by these officials of the strike situation. There were several meetings of union miners that afternoon at which agitators told the strikers to use force of arms against any officers of the law who should attempt to arrest them in their homes. Indeed it is thought that Sunday was an eventful day and probably developed conditions which will go a long ways toward restoring law and order. In the morning several of the Houghton business men met at the Houghton Club and formulated plans of action; after this meeting they adjourned to the Houghton fire hall, sounded fire alarms for several minutes at a time, gathered together all of the citizens who could be reached for the purpose of getting the views of citizens in all walks of life. Many speeches were made and result was chartering of a special train over the Copper Range railroad and the whole party going to Calumet, where they planned a similar meeting for the citizens there. When the Houghton party reached Calumet few Calumet people knew anything of the plan, but after meeting got well started the armory, where the meeting was held, was crowded. Result of the meeting was that next Wednesday is to be a half holiday with full pay and patriotic meetings will be held in the several copper country towns. Good speakers will be engaged and it is thought that before the week is over the agitators will find things too much against them to warrant their remaining. After they go it will be a simple matter, comparatively, to adjust differences between men and mining companies. Workmen at Painesdale broke up the strikers' parade Dec. 8, and then held an indignation meeting. They threaten the lives of the agitators, and trouble is feared. At Baltic 150 strikers were ordered to stop when crossing mine property.

NEGAUNEE—Dec. 6

Water Power on the Menominee River at Quinnesec Falls is being further developed by the Steel Corporation, supplementing a hydraulic plant that for many years has supplied compressed air to the Chapin mine at Iron Mountain. Work on the new hydro-electric plant has been in progress for several months. The power building, which is of concrete, as is the dam, is reinforced with steel. It is 55x61 ft., and three stories high. More than 25 carloads of machinery have arrived and been delivered at the site, hauled from the railroad yards to the river by teams of horses. The steel towers which will carry the transmission lines have been erected. The workings of the Chapin mine which pierce limestone are exceptionally wet. The property not only makes water regularly, but at times is afflicted with excessive flows. Necessarily, the mine has a powerful pumping equipment and it has as well bailers for use in emergencies. It was principally to offset the extra expense of pumping that it was decided by the Chapin's original management, the late Senator M. A. Hanna, of Cleveland, who was president of the company at the time of its acquisition by the Steel Corporation, to harness the Quinnesec Falls and procure cheap power. The hydraulic plant was established in 1883 and has since been improved from time to time, one of the principal betterments being the substitution of turbines for undershot wheels. There are four turbines at present, each geared to a duplex air compressor. The plant has a capacity of 20,000 cu.ft. of free air per minute. The air is forced through a steel main 16,666 ft. long at a pressure of 65 to 70 lb. at the river and reaches the mine at a pressure averaging 5 lb. less. Power drills and small underground pumps are operated by the compressed air, as is much of the surface machinery. The installation of the hydro-electric plant will provide the Chapin with all the power it needs. Supplementing it will be a steam plant for use in contingencies such as may be caused by ice conditions in the river. The generating station at the falls will be equipped with two 2800-hp. Allis-Chalmers turbines, each directly connected to an 1875-kw. 2300-volt, 3-phase, 60-cycle generator. Stepped up to 13,200 volts, the electricity will be transmitted to the No. 2 Hamilton shaft at the mine. Electricity will be used in pumping, in underground tramming, in lighting and in driving motors at the stock piles and in the shops. In the sixteenth or bottom level of the mine there will be installed two motor-driven centrifugal pumps, each of a capacity of 3000 gal. per min. under a head of 450 ft. These pumps will elevate the water to the twelfth level, whence it will be forced to the surface by two six-stage motor-driven pumps of a capacity of 3000 gal. The hydro-electric plant of the Chapin will be the third installation of the kind on the Menominee iron range. The others are the plant of the Peninsula Power Co., at the Twin Falls of the Menominee River, whence electricity is transmitted to mining properties as far distant as Iron River, and the plant of the Penn Mining Co., a subsidiary of the Cambria Steel Co., at the Sturgeon Falls.

IRON RIVER—Dec. 6

Attention to Lawns and Gardens has been stimulated by the proffer of prizes to the employees at the Baltic and Caspian properties of Pickands, Mather & Co., in the Iron River field on the Menominee range. This year more than usual attention has been devoted to lawns and gardens. It is estimated that the total value of the vegetables grown in 66 gardens at the Caspian and 38 at the Baltic was close to $4000, an average of approximately $40, and $1000 in excess of the value of the crops raised the preceding year. The many well kept lawns and flower gardens have greatly improved the appearance of the mining locations. A system of awards similar to this Menominee range enterprise of General Superintendent Charles E. Lawrence, is in effect at the Marquette range mines of the Cleveland-Cliffs Iron Co.

TORONTO—Dec. 6

The Oil Rush to Alberta, where at Athabasca Landing, claims covering approximately 300,000 acres, have been staked out, was due to the operations of O. T. Ross, a California oil expert, who has been making investigations for several months. He has secured the backing of Dr. W. T. Shillington, who has been associated with mining enterprises in Cobalt, and has taken up claims on the Athabasca River, 50 miles northwest of Athabasca Landing. A standard oil-drilling outfit will be taken in over the ice this winter to be ready for the commencement of work in the spring. Ross states that he will be prepared to drill 4000 ft. if necessary, but does not expect to have to go down so far. It is not intended to put stock on the market.

THE MINING NEWS

ALASKA

SUSPENSION OF 1913 ANNUAL ASSESSMENT WORK is asked for in an appeal sent to Congress by miners of Nome district. Last season was a most disastrous one. Scarcity of water during entire summer prevented miners from making cleanups, and output was only 50% of what it would have been under favorable circumstances. Recent disaster at Nome destroyed many miners' homes and their winter outfits were lost.

ALASKA MEXICAN (Douglas)—October milling, 18,606 tons, yielding $24,650, or $1.34 per ton; estimated profit, $3262.

ALASKA TREADWELL (Douglas)—Tailings from mills having so filled up channel that big boats could not land at low water; wharf has been extended 50 ft. At Nugget Creek near Juneau work has been started on tunnel to divert water while foundation of dam is joined to bedrock. Work on earth and timber dam will commence next spring and will be completed next year.

ARIZONA

Gila County

IRON CAP (Globe)—Raise from 800 to 650 level broke through Nov. 26. Drift on 650, which is being driven to make connection with old Eureka shaft of Arizona Commercial, is expected to "hole through" at each round.

SUPERIOR & BOSTON (Globe)—Vein on sixth level, which was abruptly cut off by mass of diabase, has been relocated through diamond-drill hole which was started some time ago. Hole was drilled southerly at an angle of 60° with strike of vein. At a distance of 187 ft. it encountered vein and at 210 ft. is still in lode.

INTERNATIONAL SMELTING & REFINING CO. (Miami)—Survey for site of new smelter, which is being erected by International Smelting & Refining Co. at Miami, has been completed and work of grading is in progress. Construction will be under supervision of Repath & McGregor. According to present plans new plant will contain three reverberatory furnaces, with probably one blast furnace and six or seven converter stands. Site is in same valley as Inspiration concentrator, directly north of Miami mine and approximately equidistant between it and Inspiration mill. In addition to smelting Inspiration concentrates, Miami concentrates will be treated. Combined annual copper production of Miami and Inspiration should approximate 110,000,000 lb. Ores from numerous small mines in Miami district will probably be treated in new plant, also those adjacent to Globe, and other Southwestern properties which have been sending their ores to El Paso with a long freight haul.

Maricopa County

RED ROVER (Phoenix)—Work has been resumed. Ore will be shipped to smelter at Douglas.

MAMMOTH (Mesa)—Stamp mill and cyanide plant are in commission. Much ore is ready for milling and plant may be enlarged.

VULTURE (Wickenburg)—During the last nine months gold bullion worth $276,772 and concentrates worth $152,643 were produced.

MAX-DELTA (Phœnix)—Probably a gravity tramway will be built and as good milling ore has been blocked out by recent development a mill may be built.

Mohave County

C. O. D. (Kingman)—Mine has been taken under option by Qualey Bros., of New York. A large mine-pumping plant is to be installed. This is considered one of the largest base-metal mines in county.

Pinal County

CALUMET & ARIZONA (Superior)—High-grade silver ore is being sacked and shipped. Great improvements have been made in roads between Ray and Superior. Automobiles and teams make trips daily now and travel has reached a stage to warrant establishment of a roadhouse between Ray and Superior; this on a road where W. D. Fisk only a short time ago put first automobile through with ropes and a cow pony.

Santa Cruz County

R. R. R. (Patagonia)—Considerable difficulty is being experienced in securing enough cars to transport ore. Loading platform at Bloxton is filled to limit and considerable ore is being stored in drifts at mine. Since property was taken over by N. L. Amster 530 cars of high-grade ore have been shipped.

Yavapai County

HAYES (Turkey Creek)—J. P. Cleator and William Parker are operating mine under lease, treating free-milling ores in Parker mill.

COPPER-GOLD ZONE MINES CO. (McCabe)—New English company having taken over Henrietta and Nigger Brown mines has already begun operations. New company will complete lower tunnel on Henrietta, which is 1300 ft. long but lacks 200 ft. of cutting oreshoot. This will give additional 200 ft. of backs. The 200-ft. shaft on Nigger Brown property will be sunk several hundred feet, it being plan to thoroughly develop mines before attempting milling. A force of men is putting camp in order, preparatory to extensive work.

CALIFORNIA

Nevada County

GASTON (Gaston via Washington)—Mine and upper mill will be operated during winter. Lower mill will be enlarged next spring.

ETHEL (Washington)—Judgment in favor of B. Goodwin and Citizens Bank of Grass Valley has been rendered and property ordered sold in satisfaction of $13,737. Ethel Gold Mining Co. was obliged to mortgage mine in order to satisfy creditors and was unable to pay off mortgage.

SULTANA (Grass Valley)—Working shaft has been abandoned, but mine is to be worked through Orleans shaft, which will be reopened. It was through operation of Orleans that vein was disclosed that resulted in expenditure of a large amount of money in Sultana and Prescott Hill mines.

Shasta County

BALAKLALA CONSOLIDATED (Coram)—Precipitation tanks for recovering copper from mine waters have been installed, system resembling installations at Iron Mountain mine. Precipitant is scrap iron. It is reported that saving will be $1500 per month. Construction of new lighting plant is progressing well.

FIELD PROCESS—Plant for desulphurizing copper ores is being installed at Redding. Roasting furnace is completed. Steel flue, 300 ft. long, to receive fumes from roaster is being built. Invention is by A. U. Field, of Stockton. Cost of installation is being borne by sale of stock chiefly to residents of Shasta County.

Sierra County

RAINBOW (Alleghany)—Property which had been sold to state for taxes has been redeemed by payment of a total of $4687, including taxes and interest.

SIERRA DEL ORO (Downieville)—Nissen mill, lately installed, is crushing lower-grade ore which has accumulated during several months' development work. A complete plant has been erected, with snow sheds, compressor plant, electric lights, and every convenience for a busy winter in this altitude. Frequent shoots of high-grade ore have been encountered during last year.

KATE HARDY (Forest)—Compressor plant has just been installed, and a shaft has been started on south side of Oregon Creek, to be sunk on east wall of vein to connect with a raise from lower tunnel at a point where rich ore was recently taken out. Vein is from 6 to 30 ft. wide, and ore mills $5 per ton gold, exclusive of high-grade shoots, which are frequently encountered in development.

TIGHTNER (Alleghany)—Twenty stamps are dropping and output of over $60,000 per month, established in August, is still being maintained, with an operating expense of but $6000 per month. A two-compartment winze is being sunk on a developed payshoot. All necessary machinery is on hand for continuing sinking all winter, and this development will be carried to a depth of at least 500 feet.

NORTH FORK (Forest)—Collapsed air pipe in this gravel mine has been repaired and operations are proceeding both in North Fork and Wisconsin adjoining. New machinery for surface plant has been installed preparatory to an all-winter campaign of development. Drifting is being continued on Uncle Sam vein, and it has been found that strike has changed from northwest with a western dip to northeast with an eastern dip. Raises are being drifted with hope of encountering bonanza believed to exist in Uncle Sam, and failing in that, winze will be sunk to greater depths, and levels driven.

Trinity County

LA GRANGE (Weaverville)—New siphon of 12-in. pipe is being installed. It will supplement present system bringing water from the Trinity River. Siphon will take water across cañon of Stewart's Fork. Main arm is 1300 ft. long and second section 1100 ft. long.

COLORADO

Clear Creek County

LAMARTINE—Development by lessees on 160-ft. level below Lamartine tunnel is meeting with success. East drift has encountered shoot of smelting ore.

GOLD FISSURE—Mine is being developed through Empress tunnel. Several drifts have been driven and it is reported that high-grade gold ore has been struck in lower workings.

OGALALIE—Mine located on Columbia Mountain near Joe Reynolds and American Sisters properties, has been developed with encouraging results. Adit has been advanced 450 ft. and has opened 10-in. vein of silver ore. Company proposes to carry on development work throughout winter.

LITTLE GIANT—In near future scheme of development of this group of mines on Red Elephant Mountain will be enlarged. Drifts will be driven on White vein to increase reserve of milling ore arleady developed and with view of prospecting unexplored territory. Development on this vein has disclosed several pockets of high-grade ore. Company plans to advance Tabor tunnel about 1000 ft. This tunnel is about 300 ft. above Commodore tunnel which was apparently driven in a barren zone. One of most important veins to be intersected by new development is Little Giant. Company is seriously considering erection of a modern mill during summer of 1914. Proposed site is Lawson on Colorado & Southern Ry. so that old Commodore compressr plant buildings may be utilized; capacity 50 tons per day.

San Juan Region

SUNNYSIDE (Silverton)—A fire burned upper tramway terminal and several other buildings Dec. 1. Mine and mill will be shut down for several weeks. Loss is estimated at $75,000, with $40,000 insurance.

Summit County

COLORADO DREDGING CO. (Breckenridge)—Gold bullion was recently shipped to Denver mint. It was result of 10 days' work and shows a cleanup of $1000 worth of gold for each 24 hours of actually dredging.

CORA BELLE MINING CO. (Montezuma)—Property on Collier Mountain is developed by six tunnels from 600 to 1000 ft. long. Silver-lead ore is product and average grade shipped to Leadville smelter is 26 oz. silver and 40% lead. Milling ore goes to Sutton, Steele & Steele Co., in Denver.

Teller County

CRESSON (Cripple Creek)—Output has been increased to 150 tons per day of low- and medium-grade ores coming from 300- down to 1100-ft. level.

GOLDEN CYCLE (Goldfield)—Caving in the stopes occurred Dec. 1, five men being entombed. Two were rescued. On morning of Dec. 2 another slide occurred, and all day 200 miners working in 25-min. shifts, attempted to reach other men, but hope has been abandoned of finding them alive, even if they escaped being crushed. More than 100 carloads of rock will have to be moved before miners can be reached. All mine work has been suspended, and adjoining Vindicator mine has curtailed work for fear that blasting may occasion further slides.

IDAHO

Cœur d'Alene District

THE SUNSET PEAK DISTRICT seems to have impressed favorably mining men who visited that region recently. Interstate-Callahan is developing into a producer, capable of an output of 300 to 500 tons daily. W. A. Clark's property is well developed, and with Idora, Amazon-Manhattan and others in almost the same advanced state question of transportation arises. Mills are to be built and opinion now favors erecting them on Beaver Creek, constructing a branch railroad down creek to North Fork and there connecting with the main line, a distance of eight miles. Probably 500 miners are now employed in Sunset district, and when regular shipping operations are under way this force will be increased to more than a thousand.

FEDORA (Murray)—Contract just finished failed to reach vein. Crosscut will be continued, however, until vein is struck. Property adjoins Jack Waite mine.

CARBONATE HILL (Mullan)—New water power plant is installed and sinking of shaft has been begun. Ore showing is best of any property south of river in Mullan district.

CALEDONIA-BUNKER HILL (Wallace)—Final step in settlement of litigation over apex of Caledonia orebody was taken Dec. 1, when capital stock was increased from $1,500,000 to $2,605,000. Threatened injunction of minority stockholders to prevent increase in capital stock failed to materialize. Bunker Hill will be represented on board of Caledonia and will receive approximately 1,300,000 shares of stock. Caledonia gets use of Kellogg tunnel through which it will haul its ore and one unit of old east mill of Bunker Hill company. Caledonia workings will be connected with an incline raise from Kellogg tunnel. Work on raise is now nearly completed. Crosscut to connect with top of raise is also being driven. It is expected that by first of year Caledonia will have a force of men stoping and mine will again be a steady producer.

Idaho County

YELLOW PINE (Clearwater)—A company of Kellogg men has taken a lease on this group on Clearwater River, about 45 miles from Stites. A 5-stamp mill will be built. Ore is rich in gold, vein is 4 ft. wide and has been traced 3000 ft. across claims. There is abundant mining timber on claims and sufficient water power can be developed to operate 100 stamps.

MICHIGAN

Iron

MILLE (Iron Mountain)—This property, which at one time produced higher grade ore than any other Menominee range property, is to be sold at public auction this month. Mine has not been worked steadily for a number of years and lease of present operators does not expire for several years, but they are anxious to relinquish their claims. There is considerable low-grade ore left and small pockets of high-grade ore.

NEGAUNEE (Negaunee)—It is believed that this mine is the only one on Marquette range, if not in district, which has added to its mining force this autumn. Most properties are compelled to lay off men when shipping comes to an end, but Negaunee did the opposite and took on 50 miners this week. Most of them were men who had been let out at Lake mine at Ishpeming and Princeton at Gwinn, all Cleveland-Cliffs properties. There is little ore in stock at present.

CLEVELAND LAKE (Ishpeming)—One shift was laid off Dec. 1 by owners, Cleveland-Cliffs Iron Co. Lake is one of largest producers of iron ore on Marquette range, and most of the ore that was stocked last winter was sent out this summer. Weakness of iron market is given as cause for curtailment. Many men who were thrown out of work were given employment at other mines owned by company. With exception of Lake Angeline mine, which works three shifts per day, there is not a single mine in Ishpeming field working with a night crew.

VERONA MINING CO. (Iron River)—Company suspended all operations at Bengal and Baltic mines several days ago and it is unlikely that further work will be done until next summer. Properties were closed down for 10 days short time ago in order to make room for stocking ore, and it was not long after resumption that word came from Cleveland to suspend all operations. Fogarty, owned by same company, has reduced its force to one shift. Company has laid off single men who were employed at Caspian. There are not many mines in operation in Iron River district, only two working in Spring Valley, and they are employing small forces.

MINNESOTA

Cuyuna Range

RADIO-ACTIVITY OF CUYUNA ORE has been investigated by George B. Woodason, who has a local reputation as a divining-rod expert. Between two photographic plates were placed several keys and coins. All were then placed inside a book, which was wrapped in lightproof paper and other covering and encased between tightly screwed boards. The whole was then buried in 7 ft. of mud at chosen location. After several hours it was taken out, and plates, on development, were found to be radiographs. [A reproduction of photograph thus obtained accompanied correspondent's letter. —Editor.]

IRON MOUNTAIN (Iron Mountain)—Contract let with Ames Iron Works, New York, for two 150-hp. horizontal-tubular boilers and complete hoisting equipment.

THOMPSON (Crosby)—In stripping operations a large body of peat has been opened. Minnesota School of Mines is making experiments to determine its commercial value.

DULUTH-BRAINERD (Ironton)—Shaft down 44 ft., leaving but 12 ft. more till orebody will be encountered. Development work will be continued throughout winter, to permit of shipments next season.

ROWE (Riverton)—Due to unseasonably mild weather, hydraulic stripping still continues, although management had planned to discontinue work some time ago. One steam shovel is now stripping.

Mesabi Range

A UNIQUE CARGO OF IRON ORE cleared from Superior, Wis., in Steamer "Verona," Nov 27. It contained five different grades of ore from as many different mines, and was loaded at three different docks, the Great Northern, Northern Pacific and Missabe. The "Verona" is last boat to load this season from Northern Pacific and Missabe docks.

COMMODORE (Virginia)—This openpit operated by Corrigan McKinney & Co., has suspended for season after shipping 500,000 tons.

MADRID (Virginia)—A. B. Coates, who has been operating this mine, an underground property within city limits of Virginia, for last two years, has served notice of cancellation of his lease, effective Dec. 31. During lease mine shipped 120,000 tons. Fee owners will operate property next year.

MISSOURI-KANSAS-OKLAHOMA

Joplin District

BARNES & M'CONNELL (Hattenville, Okla.)—New 400-ton concentrator is running on Tar Creek.

OLIVER YOUSE (Miami, Okla.)—Good drill strikes have been made on Wilbur land and also on Toovey tract.

L. C. CHURCH (Miami, Okla.)—Two shafts are being sunk on Cooper & Goodwin land and plans are being made for two mills.

POMONA (Joplin, Mo.)—Increased productions are being made. Company is working stope 11 ft. high and 40 ft. wide, at 185-ft. level.

SUNFLOWER (Alba, Mo.)—Rich lead-ore strike has been made in drift extending from main shaft. E. L. Ralston and associates are operating property.

CONNOR LAND (Carterville, Mo.)—Walter Bryant soon will start new concentrator on old Minnie P. lease. Sheet ore is being worked at depth of 190 feet.

HOO HOO (Joplin, Mo.)—George H. Jocelyn has taken over mine and concentrator and will improve plant and open new ground. Good productions are being made.

UNDERWRITERS' LAND CO. (Joplin, Mo.)—Company has new concentrator at new mine in West Joplin camp. It is near Priscilla, operated by same company and is heavy producer.

GERONIMO (Joplin, Mo.)—Concentrator is to be moved to Ragland lease by J. M. Short & Co. Geronimo has produced $150,000 worth of zinc ore, but Short declares company has lost $38,000 on property.

ORES REALTY CO. (Carl Junction, Mo.)—This company, of New York men has begun drilling on Atherton land. Mineralized ground from 175 ft. to 200 ft. has been encountered. Tract lies between Carl Junction and Neck City, and operators believe strike is in ore trend between two camps. Several thousand feet of drilling will be done, company having leased 560 acres.

St. Francois County, Mo.

ST. JOSEPH LEAD CO.—Stockholders at a recent meeting approved plan of consolidation with Doe Run Lead Co.

MONTANA

Broadwater County

KEATING (Radersburg)—A change was recently made in operating force and under new régime arrangements have been made to sink shaft from 800- to 1200-ft. level.

Chouteau County

DRILLING FOR GAS AT HAVRE is about to be started. A derrick has been put up, and boilers and drilling machinery are installed capable of drilling to a depth of 2000 ft. There is much talk in Butte on possibilities of smelting Butte zinc ores in Montana if a plentiful supply of gas is found.

Jefferson County

KING SOLOMON (Clancy)—Shaft is being sunk from 400 to 700, and a good body of ore has been cut.

BOSTON-CORBIN (Corbin)—Operations have been suspended for winter. Cold weather stopped work at concentrator.

Lewis & Clark County

BUTTE & MINNESOTA (Wolf Creek)—Plans for a 50-ton mill, to be built next season, are being made.

MONTANA

Granite County

NORTHERN BELL—This company has reconstructed its hoisting plant and is now unwatering mine preparatory to sinking shaft to greater depth.

SWASTIKA (Philipsburg)—Copper ore of good grade has been opened at depth of 160 ft. in shaft, and a west drift has been started to determine extent of find. Ore is being placed on dump for shipment.

NORTH STAR (Maxville)—At this copper property of Royal Basin Mining Co., preparations are being made for construction of concentrator; and samples of ore have been sent to testing plants to determine flow sheet.

Madison County

WATSEKA (Rochester)—It is rumored that operations may soon be started again and A. W. McCune, of Salt Lake, one of the owners, recently visited property. It is thought mine can be operated profitably by using electricity in place of steam, as formerly, the power to be conveyed over a line from Twin Bridges.

THIRD SPHYNX—The Rainbow Lode Development Co. is steadily pushing development on this claim in the Northeast part of Butte and the shaft is now down 900 ft. The crosscut on the 600-ft. level, which was driven 400 ft. and then stopped temporarily, is being extended again. It is undecided how deep the shaft will be sunk, as it will depend upon how soon ore is opened, and the prospects.

Silverbow County

BUTTE MINERS TAKING FRIEDMAN TUBERCULOSIS CURE under auspices of Butte Miners' Union number about fifty.

NORTHERN PACIFIC R.R. CO. is to pay taxes on reserved mineral rights. By a decision of Supreme Court of Montana, handed down Nov. 26, Northern Pacific is compelled to pay taxes in Montana on mineral rights it reserved in its deeds of agricultural lands. A former application of company to district court for an injunction to restrain Park County authorities from levying taxes, was denied. From data collected by state commissioner, it appears that a total of $3,357,527 would accrue to state. It is probable that case will be taken to Supreme Court of United States.

ELM ORLU (Butte)—Framework is completed and everything is nearly ready for installing some of the machinery in new zinc concentrator. Water mains from artesian wells two miles away deliver water from a pumping station at wells. Outlook at present is that concentrator will be ready for operation about Feb. 1.

BULLWHACKER (Butte)—Company expects to have its enlarged leaching plant in operation about the first of year. Only a small amount of copper is being turned out at present, but extensive development work in the mine is being continued. By first of the year company will be in a position to treat 500 tons of ore per day.

BUTTE & DULUTH (Butte)—Recent developments have been so satsfactory that plans are under way for doubling present capacity of leaching plant which is treating nearly 500 tons of ore per day. Original capacity was greatly enhanced by introduction of agitating devices by which time of leaching was reduced from one or more days to a few hours.

BOSTON & MONTANA DEVELOPMENT CO. (Butte)—Surveys for Butte, Wisdom & Pacific Ry., to be built by this company, have been completed through Big Hole Valley to Jackson, and surveyors are running a line from Dewey up Wise River to Elkhorn mines of company. Camp has been moved from Elkhorn Mountains to Wise River level, from which place a tunnel has been started into mountain.

PILOT-BUTTE (Butte)—Engineers report opening of disputed vein on 1600. Theretofore vein had not been opened between 1300 and 1800, which fact gave rise to dispute with Anaconda company over ownership of orebody on 1800, where Pilot-Butte was mining. The 1600 crosscut was driven at suggestion of Anaconda company and Pilot men claim that discovery proves their contention and their ownership of vein in question.

LA FRANCE COPPER CO. (Butte)—Assets Realization Co. a Heinze company, has filed a claim for $1,800,000 against this company on bonds and unpaid coupons which had been guaranteed by United Copper Co. Assets of latter are held by Assets Realization Co. as collateral for a loan of $1,000,000 and a sale of these assets will be ordered by receiver of United Copper Co. as soon as permission is granted for such sale by federal court. Chief holding of La France is group of claims known as Lexington mine, which has been shut down for several years.

ANACONDA (Butte)—Big sawmill of company, at Hamilton, started Nov. 20, on a two years' run. F. G. Cottrell device for electro-static precipitation of solid matter from furnace fumes is being tried out at new leaching plant at Washoe works. In roasting process, preceding leaching, some copper contained in tailings being treared, is carried off with fumes. To save this copper, electro-static precipitation has been suggested and an experimental plant was installed under direction of inventor. Plant will be made permanent, provided the saving warrants additional expense. Experiments with Cottrell device are also carried on in arsenic plant of Washoe works with a view of doing away with the more cumbersome appliances now being employed. Cottrell recently delivered a highly interesting lecture on his invention to students of Montana State School of Mines at Butte.

NEVADA

Churchill County

LAMA (Camp Terrell)—This group has been leased and development will begin at once.

NEVADA HILLS (Fairview)—Report for October shows 4450 tons milled; gross value $49,358; loss in tailings $5980; net costs $30,013; net profit $13,365. Mill recovered 87.9%; 15.5% by concentration and 72.4% by cyanidation.

Humboldt County

GOLDBANKS QUICKSILVER CO. (Goldbanks)—Buildings have been erected and furnace will be installed.

DESOTO—This property, 10 miles north of Rochester, is being operated by lessees. Crosscut will be run from tunnel, now in 900 ft., to cut Silver Reef vein.

CODD LEASE (Rochester)—A shoot of shipping-grade ore, 120 ft. long, has been opened on 150-ft. level below tunnel level. Electrical equipment will be installed.

SEVEN TROUGHS COALITION (Seven Troughs)—Winze sunk on recently discovered oreshoot below 1000-ft. level shows high-grade streak on hanging wall and 2 to 5 ft. of milling-grade ore.

Lander County

PLACER MINING FIELD NEAR BATTLE MOUNTAIN is steadily increasing in extent. Work is now being done in Galena Cañon, Willow Creek, Bannock, Pedro Gulch and Copper Cañon. Gold has also been found in paying quantity in Buster Gulch and Iron Cañon.

Lyon County

EMPIRE-NEVADA (Yerington)—Churn drilling has commenced.

COPPER BAND (Ludwig)—Shoot of high-grade copper ore has been struck in this mine, one mile northeast of Nevada-Douglas. Development work is being done on tunnel level.

MASON VALLEY MINES CO. (Thompson)—Ore receipts for week ended Nov. 27, 1913, were as follows: From Mason Valley mine, 1955 tons; from Nevada-Douglas, 908 tons; from other mines, 469 tons; total, 3332, or a daily average of 476 tons. During same week six cars of matte were shipped.

Mineral County

SILVERADO (Mt. Patterson)—This mine, an early silver producer, has been leased and will be opened at once.

Washoe County

GRANITE HILL (Reno)—Shipments of good-grade copper ore are being made. A 3-ft. shoot of ore has been opened on 180-ft. level upon which drifting is being done.

White Pine County

GOLDFIELD CONSOLIDATED (Goldfield)—Total tonnage milled in November, 28,929, yielding $348,000; net realization, $168,000.

NEW MEXICO

Grant County

CLEVELAND GROUP (Silver City)—This zinc property, in the Pinos Altos district, owned by George H. Utter, was lately reported sold to Empire Zinc Co. It is stated that sale was made for cash, a check for full amount, between $200,000 and $300,000 having been drawn.

Socorro County

MAUD MINING CO. (Mogollon)—Another contract has been let for advancing drift on 500-ft. level.

DEADWOOD (Mogollon)—Mine operation has been somewhat handicapped by water again, though about normal capacity is maintained in mill.

PACIFIC MINES CO. (Mogollon)—Installation of electric equipment is proceeding satisfactorily. Plant will likely be ready for service by Dec. 1. Burro pack trains were held up two days week before last on account of unusual storms.

LITTLE CHARLIE (Mogollon)—Shipments to custom mill have been stopped until installation of pipe line to Maud mill and connection with latter's compressor is made, when machines will be used in the stopes and development work. Pipe is on ground ready for laying, which will be started at once.

NEW YORK

St. Lawrence County

NORTHERN ORE CO. (Edwards)—This company, operating only zinc mine in New York State, is preparing to increase size of its concentrating mill in order to provide room for elaborate apparatus for separating pyrites from blende. Experiments have been in progress for over a year to attain a successful method of separating these two minerals of nearly same density. Ore is mainly composed of pyrites and blende, and is high grade. Electric power will be furnished from hydro-electric plant of Watertown Light & Power Co., six miles distant, at South Edwards, on Oswegatchie River. Development underground continues at 300- and 400-ft. depths, where drifting has blocked out a good-sized ore body.

OREGON

Baker County

COLUMBIA (Cracker)—Reduction plant is treating from 90 to 100 tons of ore per day. Amalgamation, concentration and cyanidation machinery of latest type are used.

Crook County

MAYFLOWER (Howard Post Office)—This is only quartz property in county that has a milling plant. Treatment consists of amalgamation, concentration and cyanidation, and capacity is 20 tons.

Douglas County

MAYFLOWER (Bohemia)—Amalgamation, concentration and cyanidation plant will be kept running all winter.

Lane County

WEST COAST (Bohemia)—Incidentally, through controversy over changing mail routes so that after next May, Champion will not get mail during winter months except by private contract, fact has come out as to production of gold by these properties. In protesting against action of government, statement is made that during last two years production was $100,000. This is a greater amount of gold than it was generally believed was coming out of property.

SOUTH DAKOTA

Fall River County

ARDMORE OIL CO. (Ardmore)—First oil well to be drilled in this part of South Dakota is now going down at 30 to 40 ft. daily. A trace of oil is coming up with bailings. Gas is noticeable. Some years ago railroad company drilled a well about 1500 ft. deep, all but 30 ft. of which was in Benton shales, so that it is not expected that a flowing well will be struck at less than 1500 ft. A good rig, with 72-ft. steel derrick, is installed, hole started with 12-in. casing which rests on shale at 60 ft. depth, above that being wash and clay, and company is prepared to go 4000 ft. if necessary. Drilling is being done by Ingersoll Bros.

Lawrence County

HOMESTAKE (Lead)—Announcement is made that an extra Christmas dividend of $1 per share will be paid, in addition to regular monthly disbursement of 65c. per share. This will make the total disbursement for December $420,414 and total for 1913, $2,167,620. Monthly dividends for next year will be at rate of 75c. per share. It is stated that net divisible earnings of company for current year will be $10 to $11 per share, and dividends will absorb $8.80, leaving a good balance to be carried to surplus. Numerous economies have been effected within last year or two, probably most important of which is operation of stamp mills by electric power generated at Spearfish hydroelectric plant, which has now been in full operation a little more than a year. Last July 20 stamps were added to equipment, and it is understood that 40 more will be placed in Amicus mill at an early date. Notwithstanding increased tonnage being handled, work of mining is being carried on with a smaller crew than ever before. A caving system, by which ore is drawn from surface to 500-ft. level, has resulted in a large economy of labor and dynamite.

Pennington County

CHICAGO MICA CO. (Keystone)—Regular shipments of scrap and sheet mica are being made. Sheets are bringing top prices in Eastern markets, and outlook is good.

HILL CITY MINING & DEVELOPMENT CO. (Hill City)—State securities commission, which enforces new "blue-sky" law, gave company permission to sell stock. Machinery is being installed with which shaft will be sunk 200 ft. further, making it 300 ft. deep.

CONTINENTAL COPPER (Hill City)—Prospecting and development of surface showings is being done at a number of places. Machinery repairs are being made, and sinking will soon be under way. Shaft is 700 ft. deep and in copper ore for several hundred feet. It is now proposed thoroughly to explore property, after an idleness of several years.

UTAH

Beaver County

MAJESTIC (Milford)—Shaft which is being sunk on Hoosier Boy will be down 200 ft. in a short time, when drifting will be started to get under lead ore deposits.

LEONORA (Star District)—A force of men has been sent to this property, and the surface equipment is being put in order in preparation for winter work.

SHEEP ROCK (Beaver)—A cyanide plant is being installed to treat several hundred tons of tailings accumulated from 5-stamp mill. Some of the tailings run as high as $6.

Juab County

IRON BLOSSOM (Silver City)—There is contention over taxes amounting to about $13,000 between officials of Utah and Juab Counties, property being near Utah-Juab line. State board of equalization has apportioned to Utah County for taxable purposes $409,325 of net proceeds of mine, taken from No. 3 shaft. Juab County claims that this sum should be apportioned to it, as all ore is mined within Juab County line, although shaft is in Utah County. A restraining order against Utah County has been issued, pending action of state board of equalization upon an application for reapportionment.

Salt Lake County

SOUTH HECLA (Alta)—During year company marketed $24,539 worth of ore. An assessment of 6c. per share has been levied.

WASATCH MINES (Alta)—Company formed by merger of Columbus, Flagstaff and Alta-Superior has levied assessment of 5c. per share on 300,000 shares of stock outstanding. There are 700,000 shares in treasury.

ALTA TUNNEL & TRANSPORTATION CO. (Alta)—Work has been started on the proposed 6000-ft. tunnel, which, when completed, will provide drainage, and transportation for mines of Alta. Winter work has been financed, and supplies laid in to last until spring. It is expected that water for power purposes will be developed. Tunnel is in 350 feet.

MICHIGAN-UTAH—A hoist has been installed in City Rocks tunnel at winze connecting with Cleaves tunnel. Some timbering has been done. Sinking is to be started from lower City Rocks tunnel, as well as development to west on 800- and 900-ft. levels. Teamsters have been scarce since completion of Salt Lake & Alta R.R., and it has been difficult to obtain teams for three-mile haul from terminus of tramway to railroad at Wasatch. On this account shipments have been held back.

Summit County

PARK CITY SHIPMENTS for the week ended Nov. 15 amounted to 3,254,968 lb.; those for the week ended Nov. 22, to 3,809,880 pounds.

SNAKE CREEK TUNNEL—Some change will have to be made in floor of tunnel before work is resumed. This will be done, while electric equipment is being installed.

AMERICAN FLAG (Park City)—A 2500-ft. pipe-line is being laid from overflow tank of Daly-Judge mill. Connections between 1000- and 1100-ft. levels are nearly completed. There is a streak of ore running well in silver, lead and gold in top of raise.

WASHINGTON

Chelan County

GRAND VIEW (Entiat)—A concentrator and cyanide plant are to be built and two additional stamps have just been added to present mill.

Snohomish County

MONTE CRISTO (Everett)—Installation of a small refinery is being considered.

Stevens County

ORIOLE (Metaline)—Excavation has been started for new concentrator of 50 tons capacity.

PHIL SHERIDAN (Republic)—W. R. Foley, Denver, has taken a lease on this claim, at a buying figure of $30,000.

CANADA

British Columbia

CONSOLIDATED MINING & SMELTING (Trail)—A force of structural-steel workers have been engaged to erect steel for a new lead-furnace building and for installation of two large electric cranes.

GRANBY CONSOLIDATED (Anyox)—A force of men is engaged erecting bunkers and wharves and building a wagon road at lime property purchased from Harkley & Moult, and which is 25 miles down Portland Canal from Stewart.

IKEDA (Moresby Island)—This mine examined recently by an engineer representing Granby company is reported to have been acquired by it. Other properties on Moresby Island are receiving attention from same company, which has in view increasing sources of supply of fluxing ores for new smelting works on Granby Bay.

SALLY—This mine, worked for a number of years by Boundary Creek Mining & Milling Co., during which time it shipped 2000 tons of ore 50 miles by wagon road to railway, has been acquired by a Victoria syndicate and will be operated by new owners under superintendency of Alexander Robinson. Group consists of 13 claims and fractions. Tunnels have been driven on four veins, total amount of work exceeding 3000 ft. Present management is driving a new tunnel to tap an important oreshoot. Meanwhile shipping ore is being taken from old workings.

OLD SPORT—Conrad Wolfe states that he and his associates have sold a portion of this group of copper claims, near north end of Vancouver Island, in Ella Mountain district. Price is said to be $500,000. Ostensibly purchasers are W. M. Bacon and W. E. Cullen, but it is believed ownership passes to group in control of Stewart mine in Cœur d'Alenes. W. M. Bacon is manager of Stewart. W. E. Cullen, a Spokane lawyer, was a director of Stewart until August. New owners' plan to construct an electric railroad 18 miles in from coast. About $30,000 has been spent last four months in preliminary exploration.

Yukon

CANADIAN KLONDYKE MINING CO.—For week ended Nov. 22, production was 2219 oz., normal production being 3000 oz. Decrease due to accident to dredges Nos. 3 and 4. Everything is running smoothly now.

YUKON GOLD CO (Dawson)—Operations for the season ended Nov. 1. Eight dredges had been in operation and 15 hydraulic mines. Total production from Dawson properties for year, $3,780,000 against $3,975,069 last year. Total production from Dawson and Iditarod, $4,580,000 this season against $4,379,000 last. Company is operating California and British Columbia properties for which season has not closed.

MEXICO

Aguascalientes

AMERICAN SMELTING & REFINING CO. (Aguascalientes)—Smelter is operating at 50% capacity, only plant of company in Mexico now running. Officials deny that orders have been issued to close down all Mexican plants. Company will continue to operate wherever it can, and will follow policy of observing strictest impartiality in its dealings with all political parties.

Baja California

WEST MEXICO MINES CO.—Addition of concentrators to present plant is of vital importance and at present operations are suspended until arrival of a separator and two concentrating tables. Principal mine of company, "San Lorenzo," is opening up in fine shape and a new and distinct strike has been made in this property of a large orebody carrying over 2 oz. of gold per ton and some silver.

BRAZILAR Y ANEXAS—During September a shipment oxidized ore was made from "Guasabe" mine, which is one of three properties owned by syndicate. Up to date over 3500 tons of ore worth $50 per ton has been treated and all of this came from "Guasabe" property. This mine also has a good grade lead-silver ore and a parcel has been shipped to Selby smelter.

Jalisco

AMAJAC MINES CO. (Hostotipaquillo)—This Pennsylvania company has suspended operations, pending some assurance from authorities that its properties will be protected from bandits. Camp was raided by bandits in October, and again in November. Preliminary work on a 50-ton cyanide plant has been in progress for several months, and company is ready to take in machinery.

Sonora

SAN SAVA (Cabullona)—Incorporation papers have been filed by M. S. Vinnie and others and claims are now owned by San Sava Mining Co. Property is six miles east of Cabullona and 15 miles south of Douglas.

COLOMBIA

PATO MINES, LTD. (Zaragoza)—Pato dredge is even exceeding its remarkable record of last few months, production for week ended Nov. 11 being at rate of over $1.20 per cu. yd. Cleanup as cabled to London for that week amounted to $31,250 from 25,250 cu.yd. washed.

THE MARKET REPORT

METAL MARKETS

NEW YORK—Dec. 10

The metal markets have continued rather dull and somewhat irregular in prices. There is a general opinion that consumption is decreasing.

Owing to an error in transmission, the price of silver in New York on Dec. 3 was given in our last issue as 57½c. per oz. The correct quotation is 57⅝c. for that date.

MONTHLY INDEX NUMBERS

Month	1912	1913	Month	1912	1913	Month	1912	1913
Jan.	111	126	May	118	126	Sept.	127	118
Feb.	109	125	June	117	117	Oct.	133	114
March	111	125	July	114	110	Nov.	129	110
April	115	124	Aug.	120	116	Dec.	129	...

Average for year 1912, 119; year 1911, 112; year 1910, 115; year 1909, 115.
Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Copper, Tin, Lead and Zinc

Copper—During the last week the formal asking prices were abandoned, all producers becoming willing to entertain reasonable bids and respectively soliciting business. Right through the week electrolytic copper was offered at 14⅜c., delivered at home or in Europe on the usual terms, and buyers were met at below that price. Domestic consumers did not, however, become interested and sales to them were insignificant.

In the early part of the week some considerable tonnage was placed with the European consumers at 14¼c. delivered, equivalent to about 14.05c., New York, this business being for December and January shipments. On Dec. 9 some sales were made at 14.27½@14.30c., delivered, and on Dec. 10 sales were made at about the same prices in the early part of the day, but in the latter part some sales at 14⅜c., delivered, or slightly under, were reported.

The situation in Lake copper remains about as previously, in that the Calumet & Hecla is the only producer having any considerable supply to offer. In the early part of the week it was reported as naming a price of 14⅞@15c. for its special brands and making some sales thereat.

Casting copper continues to be a drug in the market, the accumulation of it increasing further during November. It is offered at concessions without finding buyers.

Regarding the market generally, it looks as if consumers in this country are waiting for copper delivered to them at 14c. On the other hand it looks as if European consumers had about exhausted their supplies, the fair amount of business lately done with them indicating this; and a considerable business with Europe is expected in the near future.

At the close Lake copper is quoted nominally at 14¾@15c., and electrolytic in cakes, ingots and wirebars at 14.05@14.15c. We quote casting copper nominally at 12¾@14c. as an average for the week.

Standard copper in London has fluctuated within narrow limits, and spot is held around £65 10s.; three months, £64 5s.; it closes at £65 8s. 9d. for spot and £64 6s. 3d. three months.

Base prices of copper sheets is now 20¼c. per lb. for hot rolled and 21¼c. for cold rolled. Full extras are charged and higher prices for small quantities. Copper wire is 15¾@16¼c. per lb. carload lots at mill.

Tin—The London market did not retain the firmer tendency, which was noted at the close of last week's report. On the contrary, it again became very weak. There was an evident desire on the part of the larger interests in this market to dispose of metal, and offers of both spot and future tin were freely made at concessions on the import price. There was no demand for spot material but some transactions in futures took place. The market closes steady at £171 for spot and £172 5s. for three months, and around 37½c. for December tin here.

Lead—The situation in lead is mysterious, the persistent weakness arising from causes that are not understood. On Dec. 9 the A. S. & R. Co. reduced its price to 4c., but independents had previously been selling as low as that, and there ensued some further cutting. At the lower prices, however, there is decidedly more interest shown, it being generally recognized that the price of lead is getting down to a point at which some of the mines cannot produce at a profit.

The London market is firmer, Spanish lead being quoted £17 17s. 6d. and English lead £18 5s. per ton.

Spelter—A round tonnage was sold at 4.97½c., St. Louis, sales extending through the week. The principal consumer has remained out of the market. Smelters assume different attitudes. Several of them have large accumulations of stock. Some have wanted to sell, while others are quite content to lay low, especially in view of the sharp restriction of production. In conservative opinion this market is thought to be scraping bottom. We quote 4.95@5c., St. Louis and 5.10@5.15c., New York.

In London the market is also firmer, good ordinaries being quoted £21 5s. and specials £22 per ton.

The base price of sheet zinc in carload lots was reduced 25c. per 100 lb. on Dec. 4 and is now $7.25 per 100 lb. basis, less 8% discount, f.o.b. cars, Peru, Ill. Extras and discounts unchanged.

DAILY PRICES OF METALS

NEW YORK

Dec.	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
4	4.8540	57⅞	14⅞ @15	14.05 @14.10	38¼	4.05 @4.10	3.90 @3.95	5.10 @5.15	4.95 @5.00
			*14⅞	14.05		4.00	3.85	5.10	4.95
5	4.8505	58⅜	14⅞ @15	14.05 @14.10	38¼	4.00 @4.10	3.85 @3.95	5.10 @5.15	4.95 @5.00
			14⅞	14.05		4.00	3.85	5.10	4.95
6	4.8525	58⅞	@15	@14.10	38¼	@4.05	@3.90	@5.15	@5.00
			*14⅞	14.05		4.00	3.85	5.10	4.95
8	4.8540	58½	@15	@14.10	37⅝	@4.05	@3.90	@5.15	@5.00
			*14⅞	14.05				5.10	4.95
9	4.8530	58¼	@15	@14.10	37⅜	4.00	3.85	@5.15	@5.00
			*14⅞	14.05		3.95	3.80	5.10	4.95
10	4.8510	57⅞	@15	@14.15	37½	@4.00	@3.85	@5.15	@5.00

*Nominal.

The quotations herein given are our appraisal of the market for copper, lead, spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic. The quotations for lead represent wholesale transactions in open market for good ordinary brands, both desilverized and non-desilverized; the specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

LONDON

Dec.	Silver	Copper				Tin		Lead		Zinc	
		Spot		3 Mos.	Best Sel'd	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
		£ per Ton	Cts. per Lb.								
4	26 11/16	65⅞	14.31	64⅝	69½	174⅛	175¼	17½	3.80	20⅝	4.48
5	27	65½	14.23	64⅜	70	174¾	175¾	17⅜	3.83	20⅞	4.54
6	27¼	...	...	...	...	...	...	...	...	...	...
8	27 1/16	65½	14.23	64½	69½	172	173⅜	17½	3.80	21	4.56
9	26 15/16	65¼	14.18	64¼	68¾	170½	172	17⅜	3.83	21⅛	4.59
10	26¾	65 7/16	14.21	64 5/16	68¾	171	172¼	17⅞	3.88	21¼	4.62

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latte being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17¼c.; £15 = 3.26c = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21¾c.

Other Metals

Aluminum—The market remains quiet and business is on a moderate scale. Prices are unchanged and we continue to quote 18¾@19¼c. per lb. for No. 1 ingots. The foreign market is quiet, but rather firm.

Antimony—Business has been quiet and prices inclined to be weak, though actual changes are small. Cookson's is 7⅜@7⅝c. per lb.; Hallett's, 7⅛@7⅜c. For Chinese, Hungarian and other outside brands, 6@6¼c. per lb. is paid.

Quicksilver—Demand continues fair and prices are steady New York quotation is $39@40 per flask of 75 lb. San Francisco, $39 for domestic orders and special terms for export. London price is £7 10s. per flask, with £7 5s. quoted from second hands.

Magnesium—Current price of pure metal is $1.50 per lb. for 100-lb. lots, New York.

Gold, Silver and Platinum

Gold—The price of gold on the open market in London was unchanged at 77s. 9d. per oz. for bars. India is still taking some gold, but the demand for Egypt is about closed.

Gold in the United States Dec. 1 is estimated by the Treasury Department as follows: Held in Treasury against gold certificates outstanding, $1,111,984,969; in Treasury current balance, $172,298,685; in banks and circulation, $633,214,789; total, $1,917,498,443, an increase of $11,596,927 during November.

Sales of gold bars from the New York Assay Office in November, were $2,852,818, being $625,062 less than in October, and $95,879 less than in November, 1912. For the 11 months ended Nov. 30, total sales were $28,523,381 in 1912, and $28,666,374 in 1913; an increase of $142,993 this year.

Iridium—Prices continue at $80@81 per oz., New York, with a fair demand.

Platinum—The market is quiet with no special change reported. The quotations remain $43@44 per oz. for refined platinum and $47@50 per oz. for hard metal.

Our Russian correspondent writes under date of Nov. 27, that the market is strong and there has been a slight advance in prices. Owing to mild weather and the absence of snow the offers of metal by the miners are considerable for the season, but they are readily taken up. Some of the large sellers are holding out of the market, anticipating higher prices. Current quotations for crude metals 83% platinum at Ekaterinburg are 9.55 rubles per zolotnik—$35.90 per oz.; at St. Petersburg, 36,700@36,800 rubles per pood—$36.02 per oz., average.

Silver—The failure of the India Specie Bank of Bombay, causing a sharp decline in bullion has been followed by the taking over in London of the silver contracts of this bank into strong hands and as a consequence silver has reacted from the lowest, closing today at 26¾d. in London.

Shipments of silver from London to the East, Jan. 1 to Nov. 27, as reported by Messrs. Pixley & Abell:

	1912	1913	Changes	
India	£9,465,000	£9,416,000	D.	£49,000
China	1,449,000	753,500	D.	695,500
Total	£10,914,000	£10,169,500	D.	£744,500

Coined silver in the United States on Dec. 1 is estimated by the Treasury Department as follows: Dollars, $565,669,263; subsidiary coin, $177,470,510; total, $743,139,773. Of the dollars, $491,524,000 are held in the Treasury against silver certificates outstanding.

Zinc and Lead Ore Markets

MONTANA ZINC ORES

Butte & Superior production in November **was about 11,000** tons of zinc concentrates.

PLATTEVILLE, WIS.—Dec. 6

The base price of 60% zinc ore declined to $37@40 per ton. The base price of 80% lead ore slumped to $48 per ton.

SHIPMENTS WEEK ENDED DEC. 6

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	2,908,100	182,000	694,500
Year to date	139,263,410	5,305,080	186,275,110

Shipped during week to separating plants, 2,847,180 lb. zinc ore.

JOPLIN, Mo.—Dec. 6

High-grade blende ore sold on a basis of $39 Thursday, strengthening to $40 at the week end, as many as 12 carloads selling on the latter base. The base per ton of 60% zinc ranged down to $38, that price being paid on what is termed a metal base for ore usually penalized for iron. Ore with 8% of iron, sold on the "metal base," is equivalent to a $44 base with deductions. Calamine dropped to $20@22 base at the week-end. The average price of all grades of zinc ore is $37.68. Lead averaged $50.70, but the week-end price dropped to $49 base of 80% metal contents. The highest price paid was $54 per ton.

SHIPMENTS WEEK ENDED DEC. 6

	Blende	Calamine	Lead	Value
Totals this week	10,939,050	1,020,240	2,009,820	$276,305
Totals 49 weeks	534,859,670	41,257,240	90,125,140	$14,554,769

Blende value, the week, $212,770; 49 weeks, $12,538,[illegible].
Calamine value, the week, $12,570; 49 weeks, $529,009.
Lead value, the week, $50,965; 49 weeks, $2,376,854.

IRON TRADE REVIEW

NEW YORK—Dec. 10

General conditions are practically unchanged. A few more orders for railroad equipment are noted, and a little more activity in structural steel. The general disposition among buyers is to hold back at least until the close of the year. Prices are not strong, though makers are less inclined to shade them in order to secure contracts than they were.

Pig iron is still quiet. Production is declining a little. Demand seems best for foundry, just now, but there is also some inquiry for basic in the West.

Pig-Iron Production—The reports of the blast furnaces, as collected and published by the "Iron Age," show that on Dec. 1, there were 227 coke and anthracite stacks in blast, having a total daily capacity of 71,700 tons; a decrease of 6850 tons from Nov. 1. Making allowance for the charcoal furnaces, the estimated make of pig iron in the United States in November was 2,265,100 tons; for the 11 months ended Nov. 30, it was 29,057,000 tons. Of this total 20,390,800 tons, or 70.2%, were made by the furnaces owned or operated by the steel company.

Alabama Pig-Iron Make in November is reported at 160,057 long tons. For the 11 months ended Nov. 30, the total make was 1,863,976 tons, an increase of 200,283 tons over last year.

PITTSBURGH—Dec. 9

Steel-mill operations have shown only a slight further decrease, being now 50 to 55% of capacity; but some mills are working much better than others. A feature of the restriction in output is that as a rule mills are running short time, down to two days a week in extreme cases, instead of closing some departments completely. Thus the employment is distributed fairly well among the men, instead of large numbers being laid off entirely. This involves a greater expense, but holds the men together, and seems to dispose of statements sometimes made by Washington newspaper correspondents, that manufacturers are trying to make hard times.

Evidences continue that the actual consumption of steel is in excess of the shipments which buyers are willing to take, and as stocks are already low the inference is strong that there will soon be an increase in demand, though possibly not a large one. In tubular goods, a branch of the finished-steel trade which seems to disclose quite accurately the actual activities among consumers, specifications received thus far this month exceed those of a similar period in any preceding month since August, though by only a narrow margin.

While there is no assurance that the declining tendency in steel prices is passed, it is a fact that in the past week the market has shown more resistance to declines than at any time since about Aug. 1. A decided disposition is manifested to stand firm on present prices, apparently in the belief that buyers are as likely to take hold at this level as at a lower level.

Pig Iron—The market has continued very dull as to actual transactions, but a little inquiry has appeared in the past two days, involving basic and forge. Bessemer is extremely quiet, while foundry is being sold only in small lots. The market appears to be scraping bottom. We quote: Bessemer, $15; basic, $13; malleable, $13.50; foundry, $13.50; forge, $13.25, at valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—The English syndicate has reduced its price $3 a ton and the German makers are meeting the new price, but thus far have not cut under it. We quote English and German, prompt and forward, at $47, Baltimore, with $2.16 freight to Pittsburgh.

Steel—The market is easily quotable on the reduced basis mentioned last week, $20 for billets and $21 for sheet bars, at maker's mill, Pittsburgh or Youngstown. The mills seem to be quite firm at this level. Very little tonnage is going in the open market, the consumption being supplied on long-term contracts, chiefly with a monthly adjustment of the price.

British Foreign Trade in Iron and Steel and manufacturers thereof is valued by the Board of Trade returns as below for the 10 months ended Oct. 31:

	Exports	Imports	Excess
Iron and steel	£45,634,880	£12,558,339	Exp. £33,076,541
Machinery, hardware, etc	51,689,811	13,394,557	Exp. 38,295,254
Total	£97,324,691	£25,952,896	Exp. £71,371,795
Total, 1912	83,191,491	22,923,598	Exp. 60,267,893

Actual tonnage of iron and steel exported was 4,015,661 in 1912, and 4,150,081 in 1913; increase, 134,420 tons. Imports were 1,623,189 tons in 1912, and 1,816,107 in 1913; increase, 192,918 tons.

IRON ORE

Shipments of iron ore from the Lake Superior region by water in November were 3,233,468 tons. The total shipments for the season to Dec. 1 were, in long tons:

Ports:	1912	1913	Changes
Escanaba	5,234,655	5,399,465	I. 164,810
Marquette	3,296,761	3,137,618	D. 159,143
Ashland	4,797,101	4,338,230	D. 458,871
Two Harbors	9,370,969	10,075,718	I. 704,749
Superior	14,240,714	13,788,343	D. 452,371
Duluth	10,495,577	12,331,126	I. 1,835,549
Total	47,435,777	49,070,500	I. 1,634,723

To the total are to be added two or three belated cargoes shipped after Dec. and the rail shipments for the year, probably about 800,000 tons, making a total of 49,900,000 tons for the season.

German Iron-Ore Imports, 10 months ended Oct. 31, were 11,836,281 tons; exports, 2,168,607 tons. Imports of manganese ore were 573,293 tons; exports, 7219 tons.

COKE

The Connellsville "Courier" reports the coke production in that region for last week at 344,108 tons, 133,170 tons being made by merchant ovens and 210,938 tons by ovens owned by steel companies. Shipments were 356,786 tons. This is a decrease from the previous week of 11,132 tons in production and 22,119 in shipments.

Coke—Consumers are showing very little disposition to take hold on contracts for first half, since prompt is available at $1.75, possibly less, and contract prices quoted are considerably higher, up to $2 held by a large number of operators.

Anthracite Shipments in November were 5,786,931 long tons, being 551,263 tons less than in October. For the 11 months ended Nov. 30, the total shipments were 57,666,076 tons in 1912, and 63,407,010 in 1913; an increase of 5,740,934 tons, or 10%, this year.

Coal Production in Holland in 1912 was 1,725,394 metric tons, an increase of 248,223 tons over 1911. The production is all from a single group of mines.

Fuel exports of Great Britain, 10 months ended Oct. 31, in long tons:

	1912	1913	Changes
Coal	52,550,191	61,257,261	I. 8,707,070
Coke	803,011	989,010	I. 185,999
Briquettes	1,252,007	1,711,865	I. 459,858
Steamer Coal	15,020,522	17,434,411	I. 2,413,889
Total	69,625,731	81,392,547	I. 11,766,816

Imports of coal were only 187,043 tons in 1912, and 16,450 tons this year.

CHEMICALS

NEW YORK—Dec. 10

The general market seems to be in fair condition, with sales on a moderate scale only.

Arsenic—The market continues dull, with abundant supplies. Dealers quote $3 per 100 lb., but this could be shaded on a good order.

Copper Sulphate—Only a moderate business is reported. Prices are unchanged at $5 per 100 lb. for carload lots and $5.25 per 100 lb. for smaller parcels.

Nitrate of Soda—Competition from the new agency continues, though some producers are holding entirely out of the market at present figures. This has made prices a shade firmer at 2.17½c. per lb. for spot, and 2.20c. for futures.

PETROLEUM

The production of petroleum in California in October is reported at 8,162,889 bbl.; deliveries, 8,419,374 bbl.; stocks Oct. 31 were 47,421,983 bbl. There were 39 new wells completed in October and 329 wells drilling at the end of the month.

COPPER SMELTER'S REPORTS

This table is compiled from reports received from the respective companies except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield then is reckoned at 97%. In computing the total American supply duplications are excluded.

	July	August	September	October	November
Alaska shipments	2,705,136	1,847,785	2,261,216	1,951,883	3,391,300
Anaconda	22,100,000	22,500,000	22,600,000	18,400,000	25,250,000
Arizona, Ltd	2,600,000	1,800,000	1,800,000	3,550,000	2,800,000
Copper Queen	8,369,607	8,252,404	8,434,803	8,292,929	7,115,991
Calumet & Ariz	3,800,000	4,500,000	4,000,000	4,500,000	.....
Chino	4,746,525	5,788,572	4,196,296	4,767,466	.....
Detroit	1,549,224	2,187,223	2,102,818	1,861,878	1,922,352
East Butte	1,060,257	1,162,007	1,233,018	1,040,997	.....
Giroux	584,546	524,953	198,178	156,084	.....
Mason Valley	908,892	867,060	918,000	1,052,000	.....
Mammoth	1,800,000	1,750,000	1,750,000	1,700,000	1,700,000
Nevada Con	5,403,919	5,989,973	4,441,671	5,898,046	.....
Ohio	601,700	689,000	685,900	698,691	.....
Old Dominion	2,526,000	2,524,000	2,679,000	2,037,000	.....
Ray	4,097,000	4,269,519	4,336,434	4,725,419	.....
Shannon	880,000	1,248,000	1,232,000	1,216,000	1,110,000
South Utah	140,000	223,498	241,843	232,269	.....
Tennessee	1,247,804	1,101,019	1,309,985	1,392,162	1,688,000
United Verde*	3,000,000	3,000,000	3,000,000	3,000,000	.....
Utah Copper Co.	9,849,043	10,302,251	11,463,905	9,929,478	.....
Lake Superior*	17,500,000	9,700,000	6,950,008	5,500,000	6,600,000
Non-rep. mines*	6,200,000	6,200,000	6,000,000	6,200,000	.....
Total prod	101,669,653	96,427,264	91,835,075	88,102,302	.....
Imp., bars, etc	29,029,990	22,474,471	35,703,660	.....	.....
Total blister	130,699,643	118,901,735	127,538,735	.....	.....
Imp. ore & matte	8,527,046	9,171,351	10,800,162	.....	.....
Total Amer	139,226,689	128,073,086	138,338,897	.....	.....
Miami†	2,890,000	3,097,500	2,688,000	2,862,050	3,230,000
Shattuck-Arizona	1,019,388	1,001,634	1,163,237	993,224	.....
Brit. Col. Cos.:					
British Col. Cop.	618,379	647,905	621,120	.....	.....
Granby	1,664,102	1,847,344	1,824,659	1,718,258	1,944,145
Mexican Cos.:					
Boleo†	2,240,720	2,264,640	2,369,920	2,424,800	.....
Cananea	3,328,000	3,186,000	3,148,000	3,682,000	3,800,000
Moctezuma	2,693,006	3,542,047	3,024,121	3,178,136	3,517,800
Other Foreign:					
Braden, Chile	1,046,000	1,572,000	1,332,000	2,006,000	1,592,000
Cape Cop., S. Af.	.....	.....	607,040	712,320	.....
Kyshtim, Russia	2,500,000	1,585,000	1,187,000	.....	.....
Spassky, Russia	660,800	1,048,320	1,025,920	983,360	.....
Exports from					
Chile	9,856,000	8,736,000	5,600,000	6,160,000	.....
Australia	10,304,000	7,720,000	6,944,000	7,728,000	.....
Arrivals–Europe‡	11,728,640	14,624,960	9,661,120	18,040,960	.....

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.
‡ Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER

	United States			Visible Stocks.		
Month	U.S.Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
XI, '12	134,695,400	69,369,795	55,906,550	76,744,964	103,801,600	180,546,564
XII	143,354,042	58,491,723	65,713,796	86,164,059	96,947,200	183,111,259
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
I, 1913	143,479,625	65,210,030	60,383,845	105,312,582	78,491,840	183,904,422
II	130,948,881	59,676,492	72,168,523	123,198,332	77,504,000	200,702,332
III	136,251,849	76,585,471	77,699,306	122,302,890	81,244,800	203,547,690
IV	135,353,402	78,158,837	85,894,727	104,269,270	87,180,800	191,450,070
V	141,319,416	81,108,321	68,285,978	75,549,108	85,948,800	161,497,908
VI	121,860,853	68,362,571	68,067,901	67,474,225	77,235,200	144,709,425
VII	138,074,602	58,904,192	78,480,071	52,814,606	71,904,000	124,808,606
VIII	131,632,362	73,649,801	73,263,469	53,594,945	66,420,480	120,015,385
IX	131,401,229	66,836,897	73,085,275	38,314,037	63,716,800	102,030,837
X	139,070,481	68,173,720	68,123,473	29,793,094	53,625,600	83,418,692
XI	134,087,708	48,656,858	70,067,803	32,566,382	48,787,200	81,353,582
XII	.....	.....	.....	47,929,429	46,592,000	94,521,429

Note—From Jan. 1, 1913, visible supplies in Europe do not include copper afloat.

Mining Companies—United States

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest	Amt.
Acacia, g	Colo.	1,438,989	$ 1	$ 129,618	Jan '11	$0.01
Adams, s.l.c.	Colo.	80,000	10	778,000	Dec. '09	0.04
Ahmeek, c.	Mich.	50,000	25	2,100,000	Oct. '13	3.00
Alaska Mexican, g.	Alas.	180,000	5	3,277,381	Nov. '13	0.20
Alaska Treadwell, g.	Alas.	200,000	25	13,585,000	Nov. '13	1.00
Alaska United, g.	Alas.	180,200	5	1,487,250	Nov. '13	0.50
Am. Zinc, Lead & Sm.	U. S.	165,360	25	985,820	Apr. '13	0.50
Anaconda, c.	Mont.	1,332,500	25	81,418,125	Oct. '13	0.75
Argonaut, g.	Calif.	200,000	5	1,200,000	June '10	0.05
Arizona Copper, pf.	Ariz.	1,426,120	1.20	1,836,780	Oct. '13	.....
Arizona Copper, com.	Ariz.	1,519,896	1.20	16,037,317	Nov. '13	.....
Bagdad-Chase, g., pf.	Calif.	84,819	5	202,394	Jan. '09	0.10
Baltic, c.	Mich.	100,000	25	7,750,000	Dec. '12	7.00
Bingham N. H., c.	Utah	228,690	5	339,957	Nov. '13	0.10
Bonanza Dev., g.	Colo.	300,000	1	1,425,000	Oct. '11	0.20
Bunker Hill Con., g.	Calif.	200,000	1	791,000	Nov. '13	0.05
Bunker Hill & Sul., l.s.	Ida.	327,000	10	14,647,500	Nov. '13	0.25
Butte-Alex Scott, c.	Mont.	74,000	10	148,000	Oct. '13	0.50
Butte & Ballaklava, c.	Mont.	250,000	10	125,000	Aug. '10	0.50
Caledonia, l.s.c.	Ida.	1,300,000	1	52,000	June '10	0.01
Calumet & Arizona, c.	Ariz.	596,353	10	15,170,882	Sept. '13	1.25
Calumet & Hecla, c.	Mich.	100,000	25	122,650,000	Sept. '13	10.00
Camp Bird, g.s.	Colo.	1,100,051	5	9,650,812	Aug. '13	0.24
Centen'l-Eur., l.s.g.c.	Utah	100,000	5	3,750,000	Apr. '13	1.50
Center Creek, l.z.	Mo.	100,000	10	425,000	July '13	0.05
Champion, c.	Mich.	100,000	25	8,100,000	Oct. '13	1.00
Chief Consolidated, s.g.l.	Utah	876,453	1	175,290	Sept. '13	0.10
Cliff, g.	Utah	300,000	1	120,000	Jan. '13	0.10
Cliff, g.	Alas.	100,000	1	180,000	Nov. '12	0.05
Colo. Gold Dredging	Colo.	100,000	10	325,000	Oct. '13	0.25
Colorado, l.s.g.	Utah	1,000,000	0.20	2,570,000	Dec. '12	0.03
Columbus Con., g.s.	Utah	235,540	5	226,832	Oct. '07	0.20
Commercial Gold	Ore.	1,750,000	1	43,750	Dec. '10	0.00½
Con. Mercur, g.	Utah	1,000,000	1	3,415,313	July '12	0.03
Continental, z.l.	Mo.	22,000	25	297,000	July '13	0.50
Copper Range Con., c.	Mich.	393,445	100	13,935,021	Oct. '13	0.75
Daly Judge, s.l.	Utah	300,000	1	620,000	Oct. '13	0.15
Daly West, s.l.	Utah	180,000	20	6,606,000	Jan. '13	0.15
Doctor Jackpot, g.	Colo.	3,000,000	0.10	45,000	Mar. '11	0.00½
Doe Run, l.	Mo.	65,782	100	3,500,974	Sept. '13	1.00
Elkton Con., g.	Colo.	2,500,000	1	3,129,460	Nov. '13	0.02
El Paso, g.	Colo.	490,000	5	1,658,545	Mar. '13	0.12½
Ernestine, g.s.	N.M.	300,000	5	400,000	Dec. '12	0.00½
Fed. M. & S., com.	Idaho	60,000	100	2,708,750	Jan. '09	1.50
Fed. M. & S., pf.	Idaho	120,000	100	9,207,851	Sept. '13	1.50
Florence, g.	Nev.	1,050,000	1	840,000	Apr. '11	0.10
Frances-Mohawk, g.	Nev.	912,000	1	546,000	Jan. '08	0.05
Free Coinage, g.	Colo.	10,000	100	180,000	Dec. '09	1.00
Fremont Con., g.	Calif.	200,000	2.50	214,000	Nov. '13	0.02
Frontier, z.	Wis.	1,250	100	146,202	Nov. '13	2.00
Gemini-Key'ne, l.g.s.	Utah	5,000	100	2,160,000	Nov. '13	10.00
Gold Chain, g.	Utah	1,000,000	1	130,000	May '13	0.03
Gold Coin of Victor.	Colo.	1,000,000	1	1,350,000	Feb. '09	0.02
Gold Dollar Con.	Colo.	2,500,000	0.10	100,000	Dec. '12	0.00½
Gold King Con., g.	Colo.	5,750,370	1	1,407,319	Dec. '11	0.03
Golden Cycle, g.	Colo.	1,500,000	5	2,621,000	Nov. '13	0.03
Golden Star, g.	Ariz.	400,000	5	140,000	Mar. '10	0.05
Goldfield Con., g.	Nev.	3,558,367	10	26,330,470	Oct. '13	0.40
Grand Central, g.	Utah	500,000	1	1,545,750	Sept. '13	0.05
Granite, g.	Colo.	1,650,000	1	269,500	Nov. '12	0.01
Hazel, g.	Cal.	900,000	1	873,000	Nov. '12	0.01
Hecla, l.s.	Idaho	1,000,000	0.25	2,930,000	Oct. '13	0.02
Hercules, l.s.	Idaho	1,000,000	1	3,650,000	July '11	0.06
Homestake, g.	S. D.	218,400	100	33,858,563	Nov. '13	0.65
Horn Silver, l.s.z.	Utah	400,000	25	5,662,000	Sept. '07	0.05
Iowa, g.s.l.	Colo.	1,666,667	1	216,832	July '13	0.00½
Iowa-Tiger Leasing g.s.	Colo.	12,655	1	13,921	Jan. '12	0.10
Iron Blossom, s.l.g.	Utah	1,000,000	0.10	1,770,000	Oct. '13	0.10
Iron Silver, s.l.g.	Colo.	500,000	20	4,700,000	Apr. '13	0.10
Jamison, g.	Cal.	390,000	10	378,300	Jan. '11	0.02
Jerry Johnson, g.	Colo.	2,500,000	0.10	150,000	Aug. '11	0.01
Kendall, g.	Mont.	500,000	5	1,475,000	Nov. '12	0.02
Kennedy, g.	Cal.	100,000	100	1,831,001	Apr. '10	0.03
King of Arizona, g.	Ariz.	200,000	1	396,000	Aug. '09	0.12
Klar Piquette, z.l.	Wis.	20,000	1	162,500	Dec. '12	0.50
Knob Hill, g.	Wash.	1,000,000	1	45,000	May '12	0.00½
Liberty Bell, g.	Colo.	130,551	5	522,093	Oct. '10	1.00
Little Bell, l.s.	Utah	300,000	1	75,000	Mar. '11	0.05
Little Florence, g.	Nev.	1,000,000	1	430,000	Jan. '08	0.03
Mammoth, g.s.c.	Utah	400,000	25	2,300,000	July '13	0.05
Mary McKinney, g.	Colo.	1,309,252	1	1,077,558	Oct. '13	0.02
May Day, g.s.l.	Utah	800,000	0.25	148,000	Feb. '13	0.03
Mexican, g.s.	Nev.	201,600	2.50	20,160	Aug. '11	0.10
Miami, c.	Ariz.	664,993	5	2,588,910	Nov. '13	0.50
Modoc, g.	Colo.	500,000	1	275,000	Dec. '11	0.01
Mohawk, c.	Mich.	100,000	25	3,175,000	Aug. '13	2.00
Monarch-Mad'a, g.s.l.	Colo.	1,000,000	1	40,000	May '11	0.01
Montana-Tonop., s.g.	Nev.	921,865	1	530,000	Dec. '12	0.10
Mountain, c.	Cal.	250,000	25	4,216,250	May '08	0.44
National, g.	Nev.	750,000	1	570,000	May '11	0.10
Nevada Con., c.	Nev.	1,999,394	5	12,987,776	Sept. '13	0.37½
New Century, z.l.	Mo.	330,000	1	237,600	Oct. '09	0.01
New Idria, q.	Cal.	100,000	5	1,720,000	Sept. '13	0.10
North Butte, c.	Mont.	410,000	15	11,275,000	Oct. '13	0.50
North Star, g.	Cal.	250,000	10	3,936,989	Sept. '13	0.20
Old Domin'n, M. & Sm.	Ariz.	162,000	25	3,361,000	Oct. '13	1.25
Ophir, s.g.	Nev.	201,600	3	2,068,360	Jan. '12	0.10
Opohongo, g.s.l.	Utah	898,978	0.25	80,907	Jan. '13	0.02
Oroville Dredging	Cal.	700,000	5	1,383,036	Dec. '09	0.12½
Osceola, c.	Mich.	96,150	25	11,891,225	Oct. '13	2.00
Parrot, c.	Mont.	229,850	10	7,290,227	Nov. '13	0.15
Pearl Con., g.	Wash.	1,909,711	0.05	181,422	Dec. '10	0.02
Pharmacist, g.	Colo.	1,500,000	1	87,500	Feb. '10	0.00½
Pioneer, g.	Alas.	5,000,000	1	4,041,526	Oct. '11	0.03
Pittsburgh-Idaho, l.	Iad.	803,000	1	216,810	Oct. '12	0.04
Pittsburgh Silver Peak, g	Nev.	2,790,000	1	723,400	Nov. '13	0.02
Portland, g.	Colo.	3,000,000	1	9,337,080	Aug. '13	0.02
Quilp	Wash.	1,500,000	1	67,500	Feb. '13	0.01
Quincy, c.	Mich.	110,000	25	20,842,500	Sept. '13	1.25
Republic, g.	Wash.	1,000,000	1	85,000	Dec. '10	0.01½
Rochester, l.z.	Mo.	4,900	100	188,396	Dec. '10	0.50
Round Mountain, g.	Nev.	866,426	1	363,365	Aug. '13	0.04

Mining Companies—United States—(*Continued*)

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest	Amt
Seven Troughs Coal., g.	Nev.	1,500,000	$ 1	$ 37,500	July '12	$0.02½
St. Joseph, l.	Mo.	1,000,000	10	8,960,357	Sept. '13	0.10
Shannon, c.	Ariz.	300,000	10	750,000	Jan. '13	0.50
Shattuck-Arizona, c.	Ariz.	350,000	10	1,575,000	Oct. '13	0.50
Silver King Coal, l.s.	Utah	1,250,000	5	2,159,885	Apr. '13	0.15
Sioux Con., s.l.g.	Utah	745,389	1	872,097	July '11	0.04
Skidoo, g.	Cal.	1,000,000	5	275,000	May '12	0.02½
Smuggler, l.s.z.	Colo.	1,000,000	1	2,235,000	Nov. '06	0.03
Snowstorm, c.g.	Ida.	1,500,000	1	1,192,103	Oct. '13	0.02
South Eureka, g.	Calif.	299,981	1	366,881	Apr. '12	0.07
Standard Con., g.s.	Cal.	178,394	10	5,274,767	Nov. '13	0.25
Stratton's Ind., g.	Colo.	1,000,000	0.60	546,750	Nov. '13	0.06
Success, z.	Ida.	1,500,000	1	925,000	May '13	0.02
Superior & Pitts., c.	Ariz.	1,499,793	10	5,369,262	Sept. '13	0.38
Tamarack, c.	Mich.	60,000	25	9,420,000	July '07	4.00
Tennessee, c.	Tenn.	200,000	25	3,631,520	Sept. '13	0.75
Tomboy, g.s.	Colo.	300,000	4.85	3,069,090	June '13	0.48
Tom Reed, g.	Ariz.	909,555	1	1,591,580	Nov. '13	0.06
Tonopah Belm't, s.g.	Nev.	1,500,000	1	5,243,000	Nov. '13	0.10
Tonopah Ext., g.s.	Nev.	943,433	1	424,529	Oct. '13	0.05
Tonopah of Nev., s.g.	Nev.	1,000,000	1	11,100,000	Sept. '13	0.25
Tri-Mountain, c.	Mich.	100,000	25	1,250,000	Dec. '12	3.00
Tuolumne, c.	Mont.	800,000	1	520,000	May '13	0.10
Uncle Sam, g.s.l.	Utah	500,000	1	495,000	Sept. '11	0.05
United Cop. Min., c.	Wash.	1,000,000	1	120,000	July '13	0.01
United (Crip. Ck.) g.	Colo.	4,000,100	1	440,435	Jan. '10	0.04
United Globe, c.	Ariz.	23,000	10	1,530,000	Oct. '13	7.50
United Verde, c.	Ariz.	300,000	10	32,797,000	Dec. '13	0.75
Utah, s.l.	Utah	100,000	10	325,000	Dec. '10	0.02
Utah, c.	Utah	1,562,599	10	19,803,111	Sept. '13	0.75
Utah Con., c.	Utah	300,000	5	8,100,000	Nov. '13	0.50
Valley View, g.	Colo.	1,000,000	1	210,000	Dec. '10	0.04
Victoria, g.s.l.	Utah	250,000	1	207,500	Mar. '10	0.04
Vindicator Con., g.	Colo.	1,500,000	1	2,767,000	Oct. '13	0.03
Wasp No. 2, g.	S. D.	500,000	1	441,965	Nov. '13	0.01
Wellington Mines, g.	Colo.	10,000,000	1	260,000	July '13	0.00½
Wolverine, c.	Mich.	60,000	25	7,940,000	Apr. '13	5.00
Work, g.	Colo.	1,500,000	1	172,500	July '08	0.00½
Yak, s.l.	Colo.	1,000,000	1	1,727,655	July '13	0.02
Yankee Con., g.s.	Utah	1,000,000	1	167,500	Jan. '13	0.01
Yellow Aster, g.	Cal.	100,000	10	1,176,789	Nov. '13	0.05
Yellow Pine, l.z.s.	Nev.	950,000	1	323,008	Nov. '13	0.02
Yukon Gold, g.	Alas.	3,500,000	5	5,250,000	Sept. '13	0.07½

Iron, Industrial and Holding Companies

Amalgamated, c.	Mont.	1,538,87[illegible]	100	$81,276,429	Nov. '13	31.50
Am. Sm. & Ref., com	U. S.	500,00[illegible]	100	24,833,333	Sept. '13	1.00
Am. Sm. & Ref., pf.	U. S.	500,00[illegible]	100	45,481,333	Sept. '13	1.75
Am. Smelters, pf. A.	U. S.	170,00[illegible]	100	8,130,000	Oct. '13	1.50
Am. Smelters, pf. B.	U. S.	300,00[illegible]	100	12,357,000	Oct. '13	1.25
Cambria Steel	Penn.	900,00[illegible]	50	18,460,000	Nov. '13	0.62½
Greene Cananea	U. S.	2,471,314	25	2,426,877	Mar. '13	0.25
Guggenheim Expl.	U. S.	831,732	25	17,897,500	Oct. '13	0.62½
Inter'l Nickel, com.	U. S.	115,826	100	10,089,316	Sept. '13	3.00
Inter'l Nickel, pfd.	U. S.	89,12[illegible]	100	4,274,192	Aug. '13	1.50
Inter'l Sm. & Ref.	U. S.	100,000	100	3,300,000	Aug. '13	2.00
National Lead, com.	N. Y.	206,554	100	7,540,308	Sept. '13	0.75
National Lead, pf.	N. Y.	243,676	100	27,560,940	Sept. '13	1.75
Old Dominion, c.	Ariz.	293,245	25	4,682,700	Oct. '13	1.25
Phelps, Dodge & Co.	U. S.	450,000	100	28,309,304	Sept. '13	4.50
U. S. Steel Corp., com.	U. S.	5,083,025	100	194,403,851	Sept. '13	1.25
U. S. Steel Corp., pf.	U. S.	3,602,811	100	345,073,658	Nov. '13	1.75
U. S. S., R. & M., com.	U.S.-Mex.	486,320	50	5,572,183	Oct. '13	0.75
U. S. S., R. & M., pf.	U.S.-Mex.	351,105	50	12,965,225	Oct. '13	0.87½

Canadian, Mexican and Central American Companies

Ajuchitlan, g.s.	Mex.	50,000	$ 5	$ 200,000	Oct. '12	$0.25
Amparo, g.s.	Mex.	2,000,000	1	1,246,884	Nov. '13	0.04
B. C. Copper	B. C.	591,709	5	615,398	Jan. '13	0.15
Beaver Con., s.	Ont.	1,996,490	1	409,879	Dec. '12	0.03
Buffalo, s.	Ont.	1,000,000	1	3,177,000	Nov. '13	0.07
Cobalt Townsite, s.	Ont.	1,000,000	1	450,000	Aug. '13	0.24
Coniagas, s.	Ont.	800,000	5	5,560,000	Nov. '13	0.70
Con. M. & S. Co. of Can	B. C.	58,052	100	1,226,269	Oct. '13	2.00
Crown Reserve, s.	Ont.	1,768,814	1	5,412,572	Nov. '13	0.02
Crow's Nest Pass C. Co.	B. C.	248,506	25	2,182,864	Mar. '11	0.25
Dominion Coal, com.	N. S.	150,000	100	5,550,000	Jan. '13	1.00
Dominion Coal, pf.	N. S.	50,000	100	4,915,000	Aug. '12	3.50
Dos Estrellas, g.s.	Mex.	300,000	0.50	14,580,000	Sept. '13	1.25
El Oro, g.s.	Mex.	1,147,500	4.85	8,947,261	July '13	0.24
Esperanza, s.g.	Mex.	455,000	4.85	11,330,455	July '13	0.36
Granby, s.l.c.	B.C.	148,496	100	5,364,794	Sept. '13	1.50
Greene Con., c.	Mex.	1,000,000	10	8,544,400	Nov. '13	0.50
Guanajuato D., pf., s.	Mex.	10,000	1000	274,356	Jan. '11	3.00
Hedley Gold	B. C.	120,000	10	1,044,000	Sept. '13	0.50
Hollinger, g.	Ont.	600,000	5	1,260,000	Nov. '13	0.15
Kerr Lake s.	Ont.	600,000	5	4,770,000	Sept. '13	0.25
La Rose Con., s.	Ont.	1,498,407	5	4,637,803	Oct. '13	0.25
Le Roi No. 2, g.	B. C.	120,000	24.30	1,471,580	Jan. '13	0.36
Lucky Tiger Com., g.	Mex.	715,337	10	2,011,552	Nov. '13	0.06
McK.-Dar. Sav. s.	Ont.	2,247,692	1	3,798,026	Oct. '13	0.10
Mines Co. of An. (new)	Mex.	1,700,000	10	*1,215,000	July '13	0.12½
N. Y. & Hond. Ros.	C. A.	150,000	10	3,192,500	Sept. '13	0.20
Nipissing, s.	Ont.	1,200,000	5	10,890,000	Oct. '13	0.37½
Peñoles, s.l.g.	Mex.	80,000	25	6,551,688	Sept. '13	1.25
Peregrina M. & M., pf.	Mex.	10,000	100	328,656	Sept. '10	3.50
Pinguico, pf., s.	Mex.	20,000	100	600,000	Oct. '11	3.00
Right of Way Mns†s.	Ont.	1,685,500	1	202,260	Dec. '11	0.02
Rio Plata, s.	Mex.	373,437	5	345,714	Feb. '13	0.05
San Rafael, g.s.	Mex.	2,400	25	1,441,180	Oct. '13	0.50
San Toy, g.s.	Mex.	6,000,000	1	540,000	July '13	0.01
Sopresa, g.s.	Mex.	19,200	20	1,517,438	Jan. '11	34.00
Stand'd Silver-Lead.	B. C.	2,000,000	1	975,000	Nov. '13	0.02½
Timiskaming, s.	Ont.	2,500,000	1	1,534,155	Apr. '13	0.06
Tem. & Hud. Bay, s.	Ont.	7,761	1	1,823,835	Aug. '13	3.00
Trethewey, s.	Ont.	1,000,000	1	961,998	Jan. '13	0.10
Wettlaufer-Lorrain, s.	Ont.	1,416,590	1	637,465	Oct. '13	0.05

*Previous to reorganization, $5,258,881.
†Previous to January, 1910, $324,644.

Assessments

Company	Delinq.	Sale	Amt.
Arctic, Ida.	Dec. 1	Dec. 31	.00025
Benton, Ida.	Nov. 25	Dec. 23	0.005
Big Cottonwood, Utah	Dec. 10	Dec. 29	0.01
Blue Star, Ida.	Nov. 25	Dec. 17	0.03
Bullion, Nev.	Dec. 12	Dec. 30	0.02
Caledonia, Nev.	Nov. 24	Dec. 18	0.05
Carbonate Center, Ida.	Nov. 5	Dec. 22	0.001
Clear Grit, Ida., postp'd.	Nov. 18	Jan. 2	0.0025
Comet Placer, Nev.	Dec. 6	Dec. 22	0.03
East Hercules, Ida.	Nov. 15	Dec. 15	0.0015
Empire, Ida., postp'd.	Oct. 30	Jan. 2	0.005
Gold Mountain Champion, Ida.	Dec. 9	Dec. 30	0.0025
Great Copper King, Ida.	Nov. 29	Dec. 29	0.001
Great Eastern, Ida.	Nov. 18	Dec. 18	0.0015
Laclede, Ida.	Nov. 24	Dec. 15	0.003
Nabob, Ida., postp'd.	Nov. 17	Dec. 21	0.005
Nevada Silver Reed, Ida.	Nov. 17	Dec. 18	0.0017
New Yerington, Nev.	Dec. 10	Dec. 30	0.01
North Franklin, Ida., postp'd.	Oct. 16	Jan. 29	0.005
Overman, Nev.	Dec. 10	Dec. 30	0.05
Plaza, Utah.	Dec. 13	Dec. 29	0.0025
Raymond-Illinois, Utah.	Nov. 28	Dec. 15	0.005
Rescue Eula, Nev.	Nov. 25	Dec. 29	0.01
Scranton Ext., Utah.	Nov. 17	Dec. 17	.00025
Seg. Belcher, Nev.	Dec. 5	Dec. 30	0.02
Silver Star, Ida., postp'd.	Nov. 22	Jan. 10	0.002
Wasatch, Utah.	Dec. 22	Jan. 8	0.05

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1911	1912	1913	1911	1912	1913
January	53.795	56.260	62.938	24.865	25.887	28.983
February	52.222	59.043	61.642	24.081	27.190	28.357
March	52.745	58.375	57.870	24.324	26.875	26.669
April	53.325	59.207	59.490	24.595	27.284	27.416
May	53.308	60.880	60.361	24.583	28.038	27.825
June	53.043	61.290	58.990	24.486	28.215	27.199
July	52.630	60.654	58.721	24.286	27.919	27.074
August	52.171	61.606	59.293	24.082	28.375	27.335
September	52.440	63.078	60.640	24.209	29.088	27.986
October	53.340	63.471	60.793	24.594	29.299	28.083
November	55.719	62.792	58.995	25.649	29.012	27.263
December	54.905	63.365	.....	25.349	29.320	.....
Year	53.304	60.835	.....	24.592	28.042	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York				London Standard	
	Electrolytic		Lake			
	1912	1913	1912	1913	1912	1913
January	14.094	16.488	14.337	16.767	62.760	71.741
February	14.084	14.971	14.329	15.253	62.893	65.519
March	14.698	14.713	14.868	14.930	65.884	65.329
April	15.741	15.291	15.930	15.565	70.294	68.111
May	16.031	15.436	16.245	15.738	72.352	68.807
June	17.234	14.672	17.443	14.871	78.259	67.140
July	17.190	14.190	17.353	14.563	76.636	64.166
August	17.498	15.400	17.644	15.904	78.670	69.200
September	17.508	16.328	17.698	16.799	78.762	73.125
October	17.314	16.337	17.661	16.913	76.389	73.383
November	17.326	15.182	17.617	16.022	76.890	68.275
December	17.376	.....	17.600	.....	75.516	.....
Year	16.341	.....	16.560	.....	72.942	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN

Month	New York		London	
	1912	1913	1912	1913
January	42.529	50.298	191.519	238.273
February	42.962	48.766	195.036	220.140
March	42.577	46.832	192.619	213.615
April	43.923	49.115	200.513	224.159
May	46.063	49.038	208.830	224.143
June	45.815	44.820	205.863	207.208
July	44.519	40.260	202.446	183.511
August	45.857	41.582	208.351	188.731
September	49.135	42.410	223.762	193.074
October	50.077	40.462	228.353	184.837
November	49.891	39.810	227.619	180.869
December	49.815	.....	226.875	.....
Av. year	46.096	.....	209.322	.....

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	4.435	4.321	4.327	4.171	15.597	17.114
February	4.026	4.325	3.946	4.175	15.738	16.550
March	4.073	4.327	4.046	4.177	15.997	15.977
April	4.200	4.381	4.118	4.242	16.331	17.597
May	4.194	4.342	4.072	4.226	16.509	18.923
June	4.392	4.325	4.321	4.190	17.588	20.226
July	4.720	4.353	4.603	4.223	18.544	20.038
August	4.569	4.624	4.452	4.550	19.655	20.406
September	5.048	4.698	4.924	4.579	22.292	20.648
October	5.071	4.402	4.894	4.253	20.630	20.302
November	4.615	4.293	4.463	4.146	18.193	19.334
December	4.303	.....	4.152	.....	18.069	.....
Year	4.471	.....	4.360	.....	17.929	.....

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	6.442	6.931	6.292	6.854	26.642	26.114
February	6.499	6.239	6.349	6.089	26.661	25.338
March	6.626	6.078	6.476	5.926	26.048	24.605
April	6.633	5.641	6.483	5.491	25.644	25.313
May	6.679	5.406	6.529	5.256	25.790	24.583
June	6.877	5.124	6.727	4.974	25.763	22.143
July	7.116	5.278	6.966	5.128	26.174	20.592
August	7.028	5.658	6.878	5.508	26.443	20.706
September	7.454	5.694	7.313	5.544	27.048	21.148
October	7.426	5.340	7.276	5.188	27.543	20.614
November	7.371	5.229	7.221	5.083	26.804	20.581
December	7.162	.....	7.081	.....	26.494	.....
Year	6.943	.....	6.799	.....	26.421	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1912	1913	1912	1913	1912	1913
January	$15.12	$18.15	$13.32	$17.35	$14.60	$18.59
February	15.03	18.15	13.28	17.22	14.01	18.13
March	14.95	18.15	13.66	16.96	14.10	17.53
April	15.13	17.90	13.90	16.71	14.15	16.40
May	15.14	17.68	13.90	15.80	14.12	15.40
June	15.15	17.14	14.11	15.40	14.22	15.10
July	15.15	16.31	14.38	15.13	14.38	14.74
August	15.43	16.63	14.90	15.00	14.85	14.88
September	16.86	16.65	16.03	15.04	15.63	14.93
October	17.90	16.60	17.18	14.61	17.22	14.80
November	18.07	16.03	17.09	13.91	18.00	14.40
December	18.15	.....	17.45	.....	18.73	.....
Year	$16.01	.....	$14.93	.....	$15.28	.....

STOCK QUOTATIONS

COLO. SPRINGS Dec. 9

Name of Comp.	Bid.
Acacia	.03
Cripple Cr'k Con.	‡.01
C. K. & N.	.07
Doctor Jack Pot	.06½
Elkton Con.	.51½
El Paso	2.75
Findlay	.01½
Gold Dollar	.07½
Gold Sovereign	.02½
Golden Cycle	1.00
Isabella	.11½
Jack Pot	.04½
Jennie Sample	.04½
Jerry Johnson	.03½
Lexington	.003
Old Gold	‡.02
Mary McKinney	.59½
Pharmacist	.01
Portland	1.05
Vindicator	.83½

SALT LAKE Dec. 9

Name of Comp.	Bid.
Beck Tunnel	.03½
Black Jack	‡.05
Cedar Talisman	.00½
Colorado Mining	.10½
Columbus Con.	‡.01
Crown Point	‡.00½
Daly-Judge	5.20
Grand Central	.53
Iron Blossom	1.15
Little Bell	‡.15
Lower Mammoth	.01½
Mason Valley	3.00
May Day	.05
Nevada Hills	.48
New York	‡.02½
Prince Con.	.22
Silver King Coal'n.	3.35
Sioux Con.	.01
Uncle Sam	.04
Yankee	‡.06

TORONTO Dec. 9

Name of Comp.	Bid.	Name of Comp.	Bid.
Bailey	.05½	Foley O'Brien	.17
Conlagas	7.00	Hollinger	17.25
T. & Hudson Bay	35.00	Imperial	‡.02
Timiskaming	.14	Jupiter	.06½
Wettlaufer-Lor.	.06	Pearl Lake	.07½
Apex	‡.01	Porcu. Gold	.14
Big Dome	‡12.00	Preston E. D.	.01½
Crown Chartered	.00½	Rea	‡.10
Dobie	‡.10	Swastika	.02
Dome Exten.	.07	West Dome	.08

SAN FRANCISCO Dec. 9

Name of Comp.	Bid	Name of Comp.	Bid
Comstock Stocks		Misc. Nev. & Cal.	
Alta	.07	Belmont	7.50
Belcher	.42	Jim Butler	.66
Best & Belcher	.06	MacNamara	.07
Caledonia	1.87½	Midway	.33
Challenge Con.	.08	Mont.-Tonopah	.90
Chollar	.03	North Star	.38
Confidence	.38	West End Con.	1.22½
Con. Virginia	.12	Atlanta	.09
Crown Point	.34	Booth	.02
Gould & Curry	.03	C.O.D. Con.	.03
Hale & Norcross	.09	Comb. Frac.	.06
Mexican	1.25	Jumbo Extension	‡.08
Occidental	.70	Pitts.-Silver Peak	.36
Ophir	.21	Round Mountain	.33
Overman	.36	Sandstorm Kendall	.05
Potosi	.04	Silver Pick	.03
Savage	.11	Argonaut	‡3.25
Sierra Nevada	.07	Bunker Hill	‡2.00
Union Con.	.14	Central Eureka	‡.23
Yellow Jacket	.35	So. Eureka	‡2.00

N. Y. EXCH. Dec. 9

Name of Comp.	Clg.
Amalgamated	69½
Am. Agri. Chem.	43½
Am.Sm.&Ref.,com.	62½
Am. Sm. & Ref., pf.	97½
Am. Sm. Sec., pf. B	81½
Anaconda	34½
Batopilas Min.	1
Bethlehem Steel,pf.	69½
Chino	37½
Federal M. & S., pf.	31½
GreatNor.,ore,ctf.	33½
Guggen. Exp.	46
Homestake	118
Inspiration Con.	14½
Miami Copper	21½
Nat'l Lead, com.	44½
National Lead, pf.	104
Nev. Consol.	14½
Phelps Dodge	188
Pittsburg Coal, pf.	88½
Quicksilver, pf.	2½
Ray Con.	17½
Republic I&S,com.	19½
Republic I&S, pf.	80½
SlossSheffi'd,com.	26
Sloss Sheffield, pf.	86
Tennessee Copper	30
Utah Copper	48
U. S. Steel, com.	56½
U. S. Steel, pf.	105
Va.Car.Chem.,pf.	97

N. Y. CURB Dec. 9

Name of Comp.	Clg.
Ariz. Belmont	‡.04½
Barnes King	1½
Beaver Con.	.30½
Big Four	.08
Boston Montana	.5
Braden Copper	7½
B. C. Copper	2½
Buffalo Mines	2 1/16
Can. G. & S.	.12
Caribou	.64
Con. Ariz. Sm.	3/16
Coppermines Cons.	2
Davis-Daly	1½
Diam'field-Daisy	.03
Ely Con.	.01½
Florence	.22
Gold Hill Con.	.20
Goldfield Con.	1½
Greene Cananea	29½
Greenwater	.06
Internat. S. & R.	‡115
Kerr Lake	4½
La Rose	1 13/16
McKinley-Dar-Sa.	1½
Min. Co. of A. new	2 1/16
New Utah Bingham	.45
Nipissing Mines	8
Ohio Copper	¼
Puebla S. & R.	2½
South Utah M&S.	‡ 3/16
Stand'd Oil of N.J.	400
Stewart	1½
Tonopah	5½
Tonopah Ex.	1 3/16
Tonopah Merger	.56
Tri-Bullion	¼
Tularosa	.50
Union Mines	‡.08
United Cop., pfd.	‡3
Yukon Gold	2

LONDON Dec. 1

Name of Comp.	Clg.
Camp Bird	£0 14s 0d
El Oro	0 14 0
Esperanza	1 0 0
Mexico Mines	5 2 6
Oroville	0 11 6
Santa Gert'dis.	0 17 6
Stratton's	0 0 9
Tomboy	1 6 10½

BOSTON EXCH Dec. 9

Name of Comp.	Clg.
Adventure	1½
Ahmeek	250
Alaska Gold M.	20½
Algomah	.90
Allouez	30½
Am. Zinc	16½
Ariz. Com., ctfs.	3½
Bonanza	.59
Boston & Corbin	‡.50
Butte & Balak	4½
Calumet & Ariz.	60½
Calumet & Hecla	395
Centennial	13
Cliff	‡1
Copper Range	33
Daly West	2½
East Butte	9½
Franklin	2½
Granby	68½
Hancock	13½
Hedley Gold	29½
Helvetia	.25
Indiana	3½
Island Cr'k, com	46
Island Cr'k, pfd.	81½
Isle Royale	17
Keweenaw	2½
Lake	5
LaSalle	3½
Mass.	2
Michigan	.60
Mohawk	38
New Arcadian	1½
New Idria Quick.	2½
North Butte	24
North Lake	1
Ojibway	.75
Old Dominion	48
Osceola	68
Quincy	54
Shannon	6½
Shattuck-Ariz.	25½
Superior	22½
Superior & Bost.	2½
Tamarack	28
Trinity	3½
Tuolumne	.65
U. S. Smelting	36½
U. S. Smelt'g, pf.	46½
Utah Apex	1½
Utah Con.	8
Victoria	1 5/16
Winona	1½
Wolverine	40
Wyandot	.50

BOSTON CURB Dec. 9

Name of Comp.	Bid
Bingham Mines	4½
Boston Ely	.44
Butte&Lon'nDev.	.32
Cactus	.01½
Calaveras	1½
Chief Cons.	1 1/16
Corbin	5
Cortez	.21
Crown Reserve	1 1/16
Eagle & Blue Bell	.93
First Nat. Cop.	2½
Houghton Copper	2½
Majestic	.22
Mexican Metals	.39
Moneta Porc.	‡.01
Nevada-Douglas	1½
New Baltic	.50
Oneco	.80
Raven Copper	.13
Rhode Island Coal	.01
Smokey Dev.	.25
So. Lake	3½
S. W. Miami	‡1½
Tonopah Victor	.25
Trethewey	.30
United Verde Ext.	.40

‡Last Quotation.